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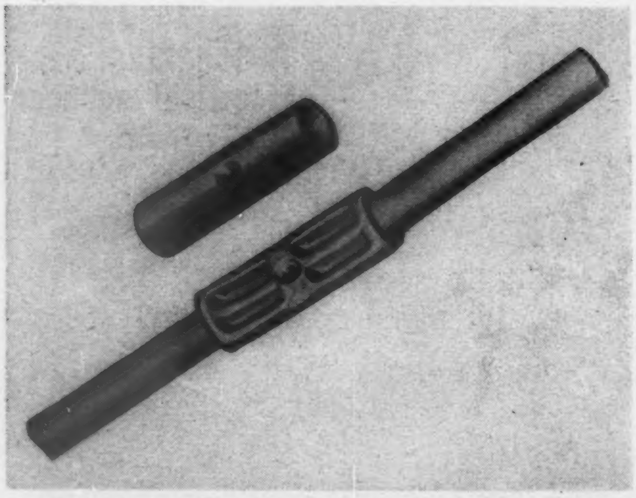
Sub-Assembly Methods Speed Car Wiring at Budd

Bench wiring, solderless terminals and special techniques assist in the installation of the more than three miles of wire used in an average car

Behind the comfort and convenience of each new passenger car with its increasingly complex electrical system, there lies a multitude of design and assembly problems. Control of power circuits, communication, lighting, heating, air conditioning, etc., have become so important that today *electrical failure* is usually synonymous with *car failure*, and as a result, wiring methods from blue print to finished car have become a specialized art. At Budd, for example, from 5,000 to 23,000 ft. of wire must be installed in each car, depending upon its type. Unlike early methods, where each car, like a house, was wired individually, the Budd Company tries to complete as much wiring as possible in sub-assembly, and it is this basic policy of pre- or bench wiring that is largely responsible for the speed, uniformity, and low cost achieved. The same basic techniques are used regardless of the number of cars on order.

Planning for the electrical program in Budd's Red Lion Plant (Philadelphia, Pa.) centers around the desired car performance, as modified by local and national electrical codes. Circuits must maintain their electrical and mechanical soundness under continuous vibration and the rugged operating conditions of all weather serv-

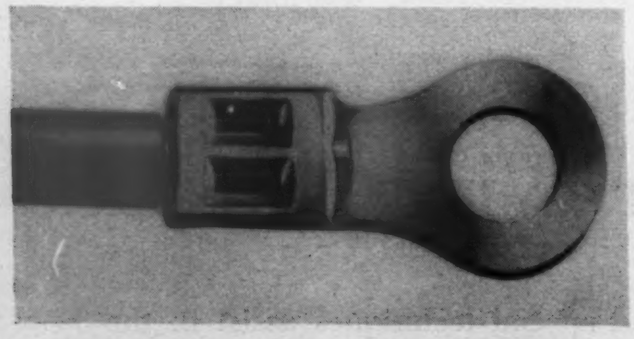


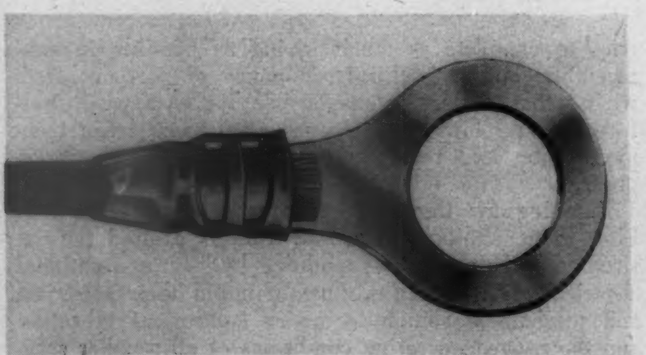
A butt connector before and after application

ice. Protection from the hazards of fire and accident are carefully considered. In addition, the actual assembly methods must be consistent with good plant economics and the wiring be as easy as possible to install.

The wiring is designed for a 20-year life span, the usual life expectancy of the car before major overhaul. This period can also be predicted by the natural aging of insulation and other such expected deterioration. For this reason little special provision is needed for maintenance, but if repair becomes necessary it will be seen that the same simplified methods of assembly lend themselves unusually well to replacement or inter-change of connection.

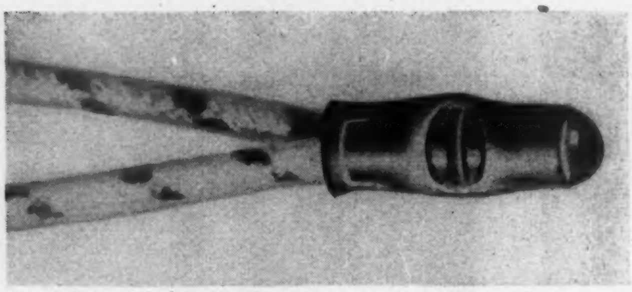
Since as much wiring as possible must be done on the bench, the problem of connection at some later time is a vital one. A necessary adjunct to this construction method is therefore the wide use of pressure type solderless terminals, lugs, and connector blocks which facilitate quick assembly of the pre-wired sections. Whereever possible units are wired, harnesses built and laid in place, and the circuits quickly completed at convenient assembly stages by means of such connectors.





Two forms of terminals used for making connection to a terminal block or bolted lug-to-lug splice

First procedure on each car order involves the preparation of electrical schematic drawings which are adjusted with buyer specifications, previous car prints,



Pre-insulated pig tail splice

or new design trends to produce finished working drawings. Actual wiring is then broken for convenience into three major divisions: roof, or *overhead*; *underfloor*; and control or *regulator*. Each division, of course, is related to the other, but in general constitutes a separate, though similar, assembly problem.

Since most heavy apparatus such as air compressors, generators, batteries, etc., are stationed beneath the car, a scale model is usually built of the underfloor division to assist in the proper routing of conduit and positioning of equipment. Such positioning is, of course, affected, in part, by the number and size of the wires to be enclosed in conduit, and in turn their length is determined by the final arrangement selected. Later a full scale mock up of the underfloor section is built to iron out actual physical assembly problems before the first or pilot car is put under construction. Power circuits fall in the underfloor division, whether from train line or self-contained generators or batteries, and feed their heavy gauge wires up to the electrical lockers or regulators which serve as a clearing house for the demand signals from the controls, switches, and thermostats scattered throughout the car. Power circuit wires go as high as 300,000 circular mils, and carry up to 800 amp. from the generator to distribution point. All wire is stranded for greater flexibility in short runs and sharp bends, and in these sizes the weight of the wire is the chief determinant of the method of termination. Lock type mechanical lugs are most often used since wires in this weight do not usually require support near the neck of the connector.

Branch circuits in the underfloor division are measured off according to blue print on long tables. Where possible they are tied, and terminated before being pulled through the conduit by Budd workers. Hand and pneumatic tools are used to attach the terminals securely in place. (See illustration).

The wiring of the regulator division is handled in similar fashion. Here it is possible to pre-wire all of the inter-connections in lockers and other controlling units. Even in these stages use can be made of harness boards which serve as a template for the locker harness.

An inverted roof exposes "overhead" duct with terminal blocks and harness in place

Budd worker uses a pneumatic tool to install Pre-insulated terminals on harness—The wires are measured off and tied on this full-size bench

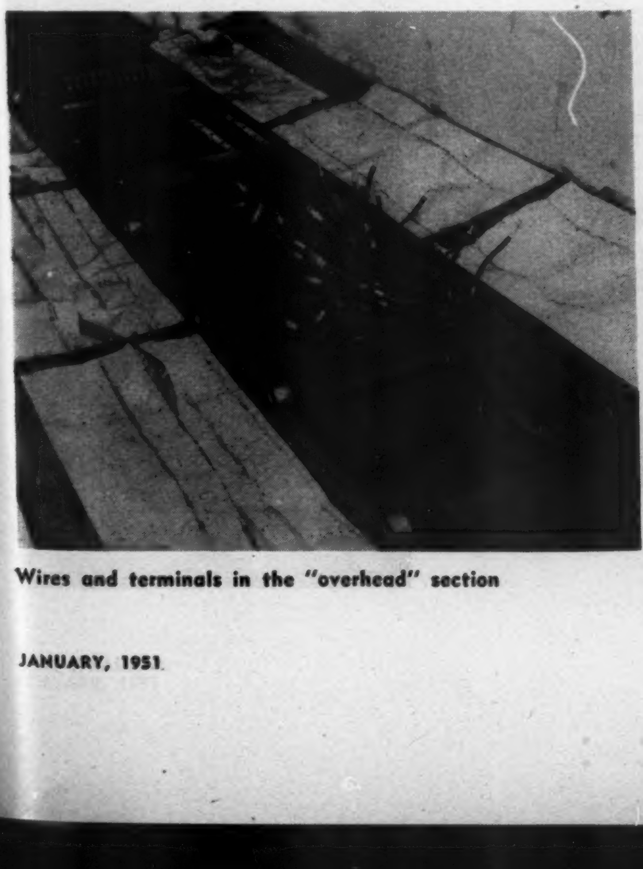
This procedure is imitated with smaller electrical apparatus or controls as they line up for installation at various station points.

Space is not a problem at Red Lion. The long assembly lines are equipped with overhead cranes which pick up roof, underframe, or the entire car in either upright or inverted position. This gives many advantages unknown to the smaller shop. As an inverted underframe arrives at station No. 004, for example, all of the heavy parts and equipment are exposed for easy insertion of steam piping and electrical conduit.

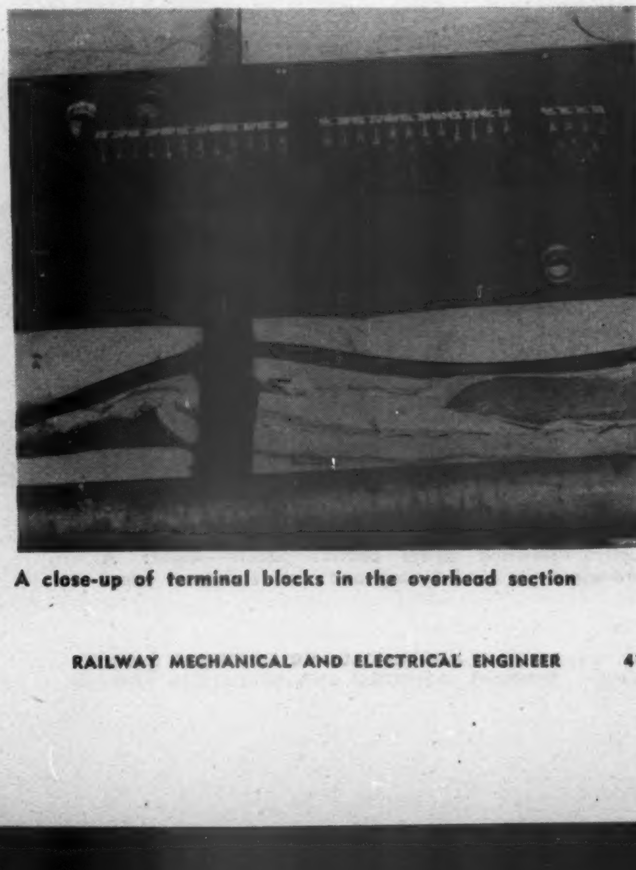
Conduit is employed wherever possible to protect the wires, serve as a guard, and prevent fires caused by a short circuit or overload of current. Underneath the car, where there is maximum exposure to weather, corrosion, etc., thick-walled conduit is used with standard threaded fittings. Wires entering suspended or movable equipment are protected by more flexible covering.

When the number of wires warrants, as in a sleeping car, duct is substituted for the thin-walled conduit usually employed in the overhead section. Threadless box connections make smooth, tight joints with safe-edge fittings to meet U.L. Underwriters specifications.

Wiring begins in the overhead section while the roof is still in an inverted position and easily accessible. Long harnesses are made and laid into position with little



Wires and terminals in the "overhead" section



A close-up of terminal blocks in the overhead section

Prewiring of control panels begins on this bench—Wires are tied, identified and terminated at this point

difficulty. Illustrations shows a Budd employee terminating leads with a pneumatic hand tool for later connection to a terminal block or similar distribution point.

The connection of the three systems is facilitated by terminal blocks which receive the pre-terminated wires to be joined in successive assembly stages. Two types of connectors are used. In the wire range from No. 8 to No. 6, where vibration is dangerous at the junction of wire and terminal barrel, the connectors used are Pre-insulated, manufactured by Aircraft-Marine Products Inc. This terminal has an outer sleeve which clamps over the wire's insulation and prevents fraying or sharp bending. In addition, the terminal is integrally insulated, so that no separate tape or tubing is required. On larger ranges, from No. 8 to No. 6, a non-insulated connector is used which features exceptionally high strength crimp. These joints are then taped.

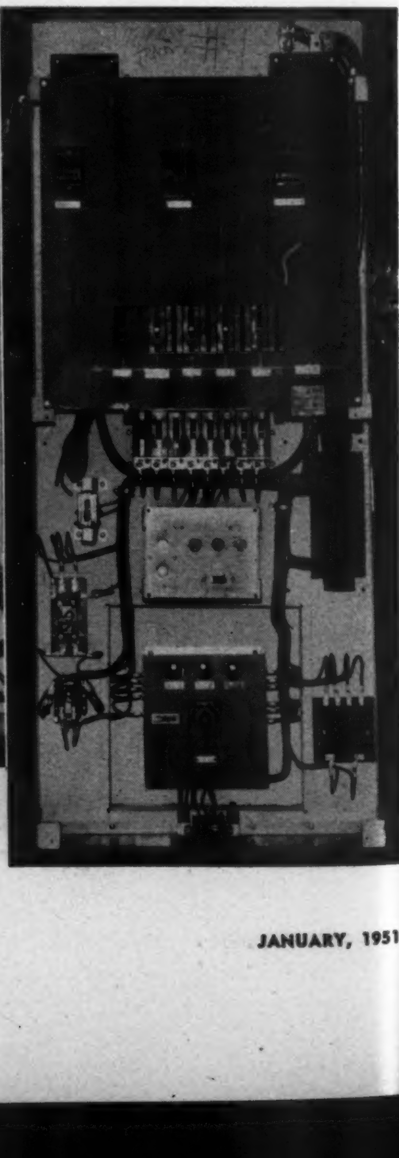
Three main types of connections are used. First by terminal block, described above, whose leads are bolted down to a common distribution point. In this case, each lead must be terminated before the harnesses or bundles of wire are laid in place. From 800 to 2,000 such solderless terminals are used in a single car.

Unterminated wires can be spliced directly with Pre-insulated closed-end connector which forms a quick, secure pig tail splice. Butt connectors can also be used to advantage in many situations requiring a direct line splice. In these cases, the only preparation needed is to strip the wire, as the connectors are already insulated and require no solder, tape or special attention.

Terminated wires are often bolted together to form a lug-to-lug splice. These connections can be easily unbolted if necessary, but offer little advantage over the direct splices which can be clipped and re-joined if necessary.

All wiring is subjected to careful tests before cars are released. In addition special climate test chambers simulate extreme operating conditions—although most of these problems have been anticipated from actual field experience.

Mass production techniques, assisted in large measure by these wiring methods, continue to be the largest single factor responsible for Budd's 36 years of efficient operation. And in the process, Budd has created a new name in car building.



Left: Pre-wired power control panels—Right: A pre-wired air conditioning and circuit control panel

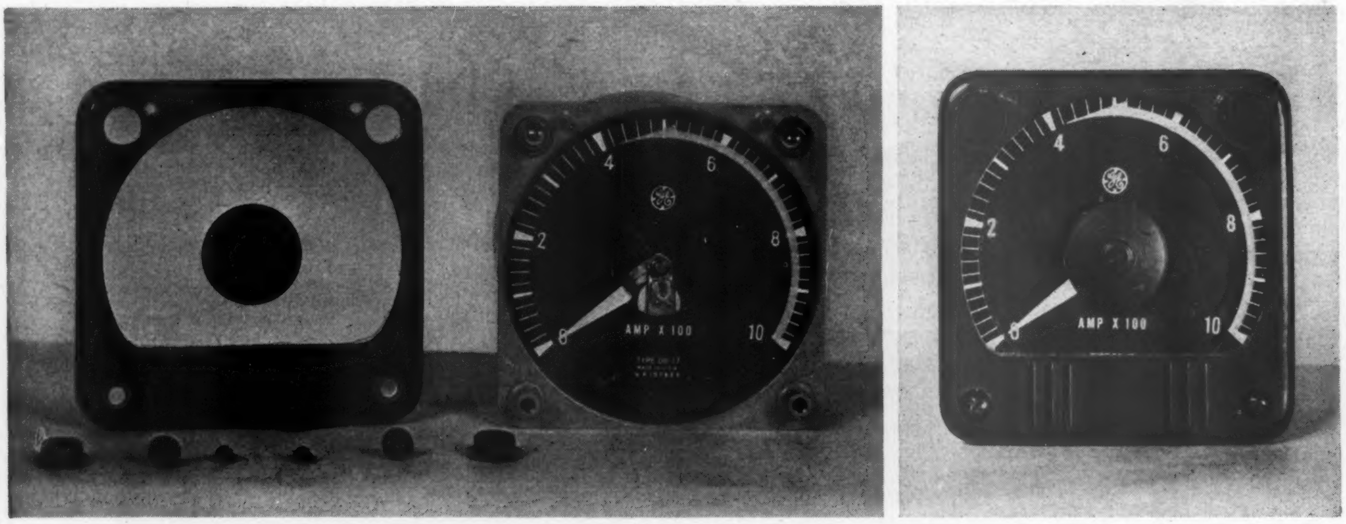


Fig. 1 (left)—Locomotive-type ammeter with cover removed to show location of lamps for illumination of dial—Fig. 2 (right) External appearance of completely assembled locomotive-type ammeter

Locomotive Instrument Lighting

Individually lighted instruments and gauges of uniform design for Diesel-electric locomotives made available by three manufacturers

By F. H. Catlin *

INSTRUMENTS play an important part in the operation of modern, electric-drive locomotives. To meet the requirements of this service, they must be accurate, rugged and easy to read under all conditions. At the same time they should meet appearance design standards and be suitable for grouping in any desired panel arrangement.

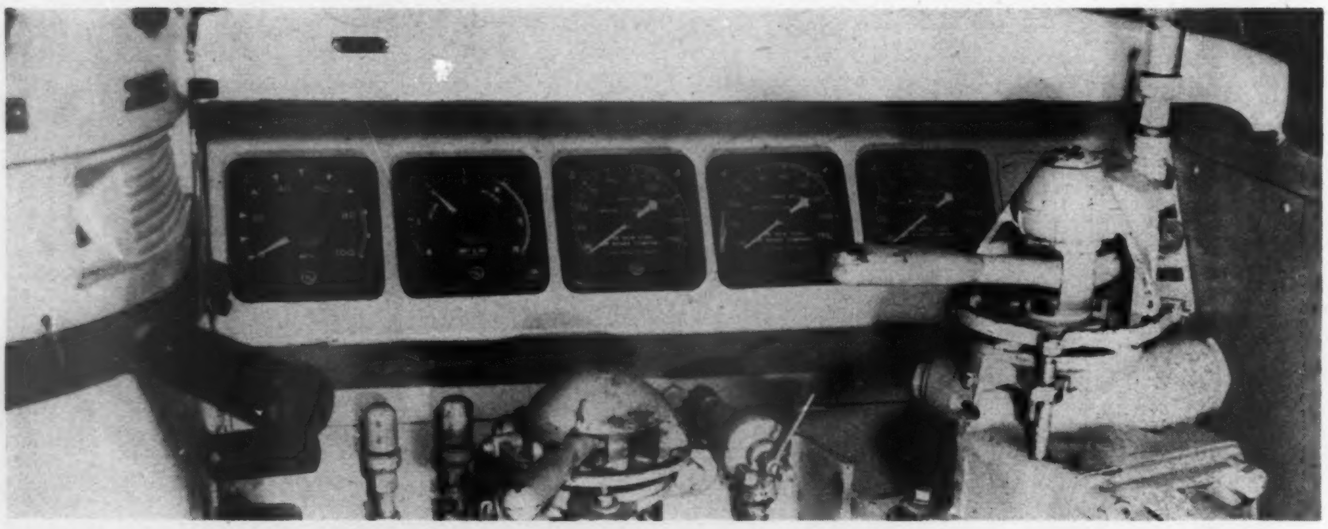
For several years, the General Electric Company has furnished a rectangular form of instrument for locomotive service which is easy to read in daylight, and can be worked satisfactorily into a system using black light illumination for night operation. An alternative type of instrument, not requiring black light, has also been developed and is now available.

With the exception of black light, the various instrument illuminating systems that have been used depended upon a central light source around which the instruments were grouped. In some designs, light was conveyed to the instrument faces by troughs extending over the edges of the front covers. In others, the instrument cases were slotted to admit light to the scale and pointers.

There are obvious disadvantages in all such systems. It is difficult to obtain satisfactory light distribution and, at times, there may be objectionable glare. The instruments are definitely confined to the location of the light source so that panel arrangements cannot be varied to meet appearance design requirements. To overcome these disadvantages, the General Electric Company has developed an illuminating system that is an integral part of each instrument case. Small lamps are mounted in the two upper corners of the instrument case in such locations that the light falls on the scale and pointer. The instrument mechanism is shielded from most of the heat

* Locomotive & Car Equipment Divisions Laboratory, General Electric Company, Erie, Pa.

Fig. 3—Duplex pressure gauge mounted in same style case



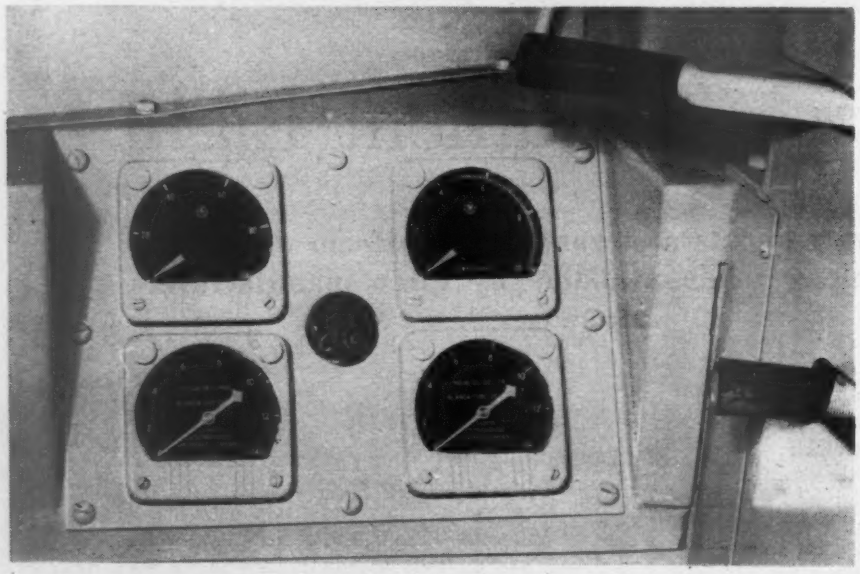


Fig. 4—(above and left) Typical engineman's instrument panels on two locomotives for mainline service, illustrating clear visibility of instruments and their flexibility of arrangement

produced by the lamps because the lamp sockets and mountings are external to the part of the case containing the instrument element.

Figure 1 shows the location of the lamps in one of the new type ammeters. The front cover and window are held in place by four screws fitting into weld nuts, two located in the lower corners and two at the top of the instrument adjacent to the lamp housings.

Figure 2 shows the instrument completely assembled with the front cover in place. Access to the lamp bulbs is obtained by removing the screw caps in the upper corners of the cover. An extractor is furnished for removing and replacing the lamp bulbs without disturbing the instrument cover. This illuminating system is available in various types of G. E. locomotive instruments, such as ammeters, speedometers, and voltmeters.

Gauges indicating pressure and temperature are also frequently used on locomotives. To insure adequate illumination and pleasing uniformity of panel appearance, there is available a line of single and duplex pressure gauges, and also duplex temperature and pressure instruments with an illumination system and front cover assembly identical to that used for the electric instruments. These are manufactured by the United States Gage Company. One of these instruments is shown in Fig. 3. In addition to the instruments shown, the Ashton Valve Company manufactures duplex vacuum gauges in the same style of case and cover assembly.

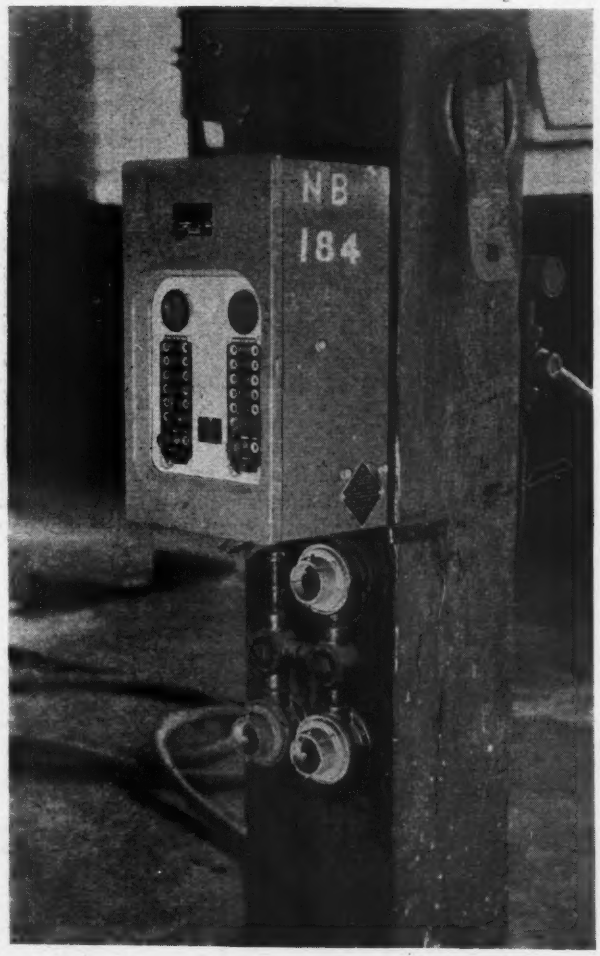
This complete line of transportation instruments offers several advantages for locomotive installations. All instruments on a control panel have a uniform appearance. All instruments are adequately lighted, regardless of their location. Light intensity can be controlled on individual instruments or on all instruments simultaneously by means of rheostats within easy reach of the engineman. All lamp wiring is accessible, and the two lamps in each instrument case can be connected in series or parallel to suit circuit conditions. Loss of illumination on one instrument has no effect on the others in the panel. The instruments do not have to be grouped around a central light source. This means that they can be used in any desired panel arrangement.

While this line of instruments was developed primarily for transportation service, the same illuminating system can be adapted to other specialized applications of G.E. 4½-in. square switchboard instruments. Other items, such as gauges, temperature and pressure indicating instruments, etc., may be obtained from gauge manufacturing companies that are equipped to produce this style of instrument.

Circuit Arrangement Facilitates Use of Charger

By W. E. Abbott

THE battery charger shown is used for charging Diesel-electric locomotive and electric-crane truck batteries. At the North Bergen, N. J., enginehouse of the New York Central, it is mounted on a column adjacent to the stall used for Diesel inspections and repairs.



Choice of receptacles below charger determines the rate of charge

The charger has two rates of charge, 6 and 12 amp. Each half of the charger will charge from one to twelve, 3-cell batteries at the rate of 6 amp. by moving a plug to the proper hole for the batteries being charged.

If the rate of charge desired is 12 amp., the two sides can be so connected that while the rate of each half is 6 amp., the total will be 12 amp.

The picture shows three receptacles mounted below the charger, they are BRA-23-T Pyle-National receptacles such as are used for cable connections between the engine and tender of steam locomotives. These receptacles are for three wires. The rubber covered cord, with three No. 14 wires, that is used on steam locomotives is used for the charging leads. A BP-35 P.N. plug is applied at one end and a battery clip at the other end, with the three wires attached to the clip.

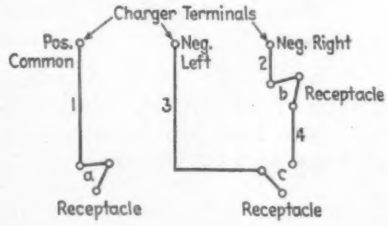
A copper disc is used in the plug end to tie the three legs together. The disc fits between the two parts of plug interior and is cut away at the screw holes where the plug assembly screws pass through the two halves so that the disc does not make contact with any part of the plug shell.

Three leads are brought out of the bottom of the charger, one positive lead common to both sides of the charge, and two negative leads, one from each side of the charger.

The positive lead *1* is brought to the receptacle *a* at the bottom left, and connected to all three of the terminals.

The negative Wire *2* from the right side of the charger is brought to the top right receptacle *b*, and connected to all three of the terminals.

The negative Wire *3*, from the left side of the charger, is brought to the bottom right receptacle and connected to two of the three terminals. Wire *4* connects the third terminal of *c* to the three terminals of *b*.



Wiring diagram for charger secondary circuits

The plug and clip used on the positive lead are painted red, and the second lead is painted gray.

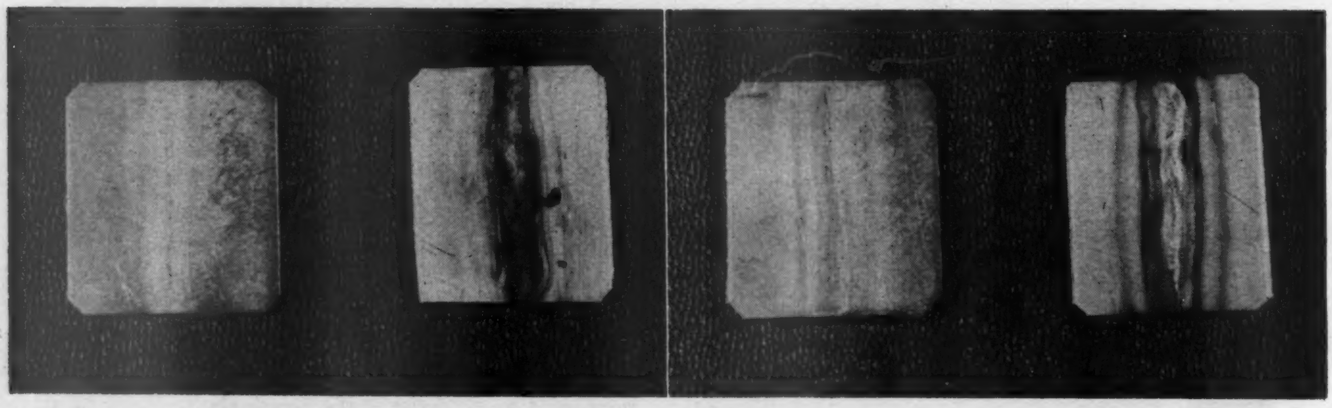
By plugging the red lead in *a*, and the gray lead in *b*, the current will be 6 amp. from the right side of the charger. Changing the gray lead to *c* will give 12 amp.

The circuit for 6-amp. charging is as follows. The common positive lead from the charger through wire *1* is connected to the three terminals of *a* and the three plug contacts tied together by the copper disk causes the current to pass through the three No. 14 wires of the cord out to the clip where they are all fastened to the clip, and attached to the positive side of the battery.

From the negative side of the battery, the circuit is carried through the clip of the negative lead, through the three wires of the lead to the plug to terminals of *b*, and through Wire *2*, to the negative side of the right side of charger.

The circuit for 12-amp. charging is as follows: the common positive side of the circuit is the same as for 6-amp. charging. The negative circuit is carried from the negative side of the battery, through the battery clip and the three wires of the lead, through the plug to the terminals of *c* and Wire *3* to the left side of the charger and through Wire *4* to the three terminals of *b* and Wire *2* to the right side of the charger.

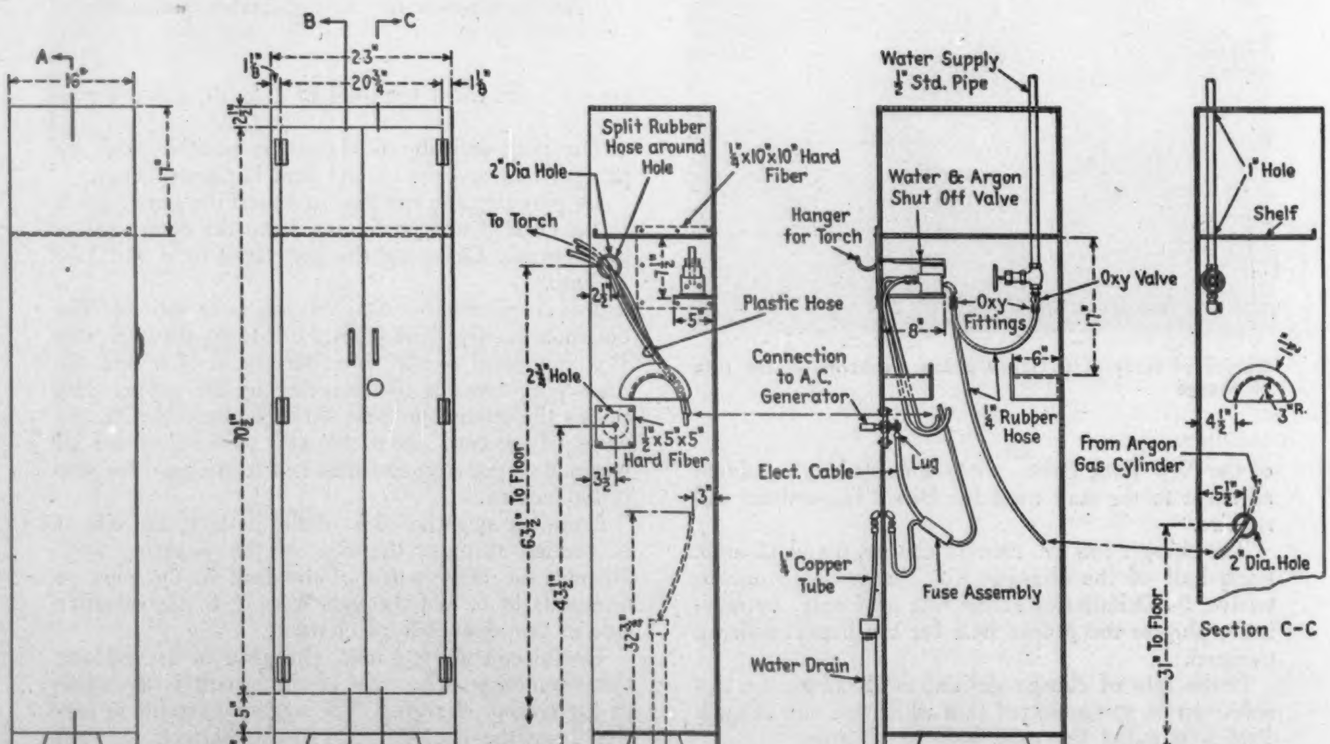
Side Sheets Without Visible Seams



Left: Samples of inert arc welding made respectively on silicone copper (left) and stainless steel (right)—Right: Reverse side of sample welds

Southern Pacific finds inert-arc welding advantageous for the welding of sheet metal in many railroad applications

THE general shop of the Southern Pacific at Los Angeles, Calif., has been equipped for inert arc welding, and experience has shown the process to be well suited to a number of railroad practices. The process is primarily a means for joining sections of sheet metal including stainless steel, aluminum and silicone copper.



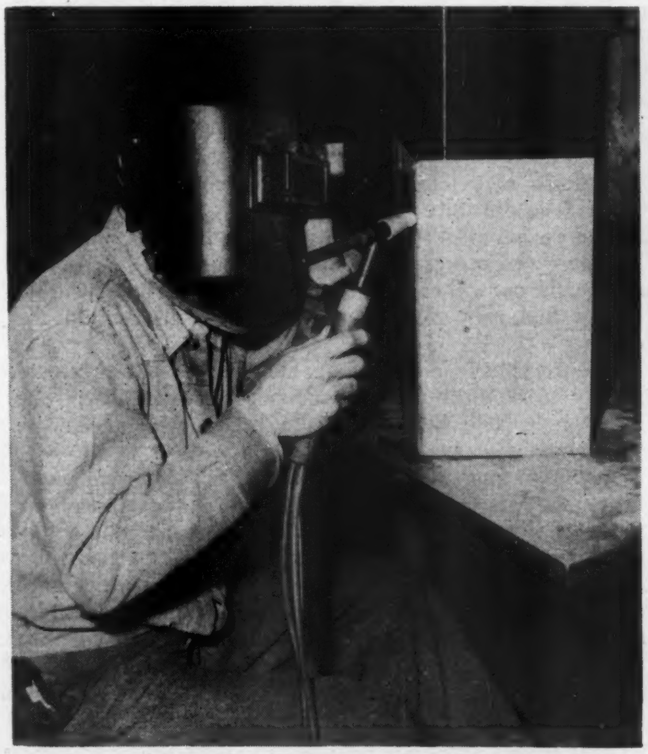
Side and front elevations of the Southern Pacific inert-arc welding service cabinet

On the Southern Pacific it is used for the welding of sheets from .02 in. to 1/8 in. in thickness. Applications include car siding, stainless steel for diner kitchens, water supply tanks for cars, fuel and water tanks for Diesel locomotives and a variety of other purposes. In most cases, the sheets to be joined are placed edge to edge and are welded without filler metal. A filler rod is used in the case of two dissimilar metals, a 10-10 Everdur rod, for example, being used to weld steel to silicone copper.

In the case of very thin metal, the edges are flanged before welding to provide filler metal. Sixteen gauge metal is welded by hand at a rate of about six inches per minute.

Shop Equipment Facilitates Performance of the Work

Car side sheets may be welded with no perceptible warping of the sheets and little fitting up is required.



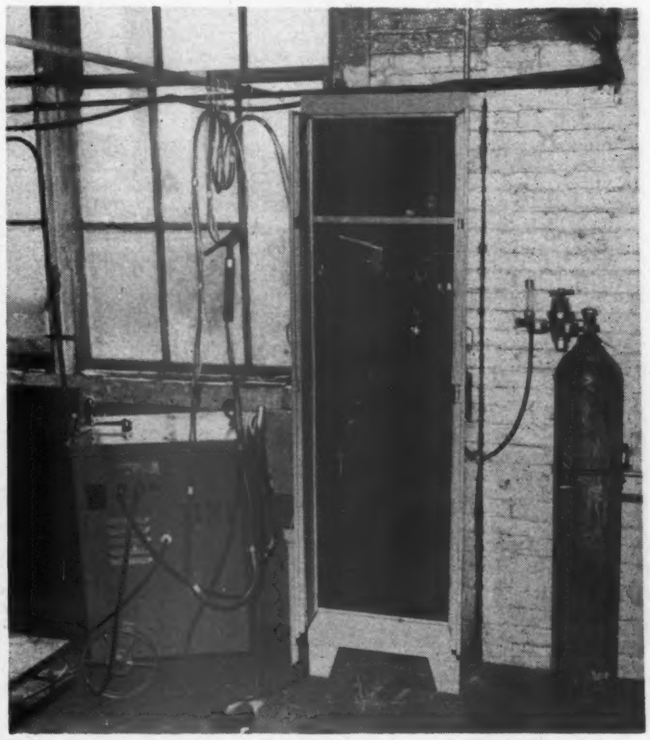
Welding a stainless steel section for a dining car kitchen

Polished-out butt welds are not visible as is the case when filler rod is used.

The welding is accomplished by means of an arc maintained between a tungsten electrode and the metal to be welded. The electrode is water-cooled and an inert gas (argon or neon) flows out around the electrode covering the arc. This protects the arc and the weld from the air and prevents the inclusion of oxygen, nitrogen and other impurities into the weld.

In the Southern Pacific installation, power for silicone copper and aluminum welding is supplied by an a.c. welding machine rated at 10 to 200 amp. It is equipped with high-frequency arc control for aluminum welding. Direct current is used for the welding of ferrous metals other than stainless steel.

A steel cabinet for storing equipment and for making all the necessary electrical gas and water connections was developed by the railroad. A water connection is brought in at the top, argon gas at one side, and an electrical connection at the opposite side provides a connection to the Flex Arc welder. Oxy-acetylene fittings are used for making water and gas connections.



Flex-arc, a.c. welder and the shop-made cabinet for storing equipment and making all necessary gas, water and electrical connections

A hook at one side of the cabinet is used to hang up the welding torch when it is not in use. This hook is on the end of an arm which operates two valves. The valves cut off the supply of gas and water when the torch is not in use.

Mercury-Vapor Lighting of Interchange Yard

The Elgin, Joliet and Eastern has recently made an installation of mercury-vapor lighting in its Griffith-Hartsdale, Indiana yard. The installation is proving to be very practical and economical.

The layouts of the track are such that ordinary floodlighting did not seem practicable. Further study indicated conventional street lighting units, mounted on high poles, would produce the needed illumination.

In the yard shown in the illustration, the E. J. & E. handles heavy interchange traffic with four other railroads. At times the yard is occupied by several trains, and a switch engine, picking up or setting out and switching cars. The lights serve effectively to increase safety and speed of operation and to reduce or prevent pilferage and damage to cars or lading.

The lights provide adequate illumination for the interchange work done in the yard and produce no objectionable glare

The lighting units are General Electric Form 109 luminaires, equipped with 16,000-lumen, Type F-H1 mercury vapor lamps. The units have top-tapped mounting and produce I. E. S. Type IV distribution.

The units are mounted on Hubbard No. 3610 chain-operated trolley-type mast arms. The length of the mast arm is 10 ft., and the mounting height of the unit is 30 ft. The horizontal spacing of the luminaires is 125 ft. (average).

Commercial power at 2,300 volts to the primary of railroad transformers is supplied from local public utility circuits. The lights are turned on and off by a Sangamo astronomic time switch.

Insert Control Facilitates Engine Testing

The Southern Pacific Taylor Diesel shops at Los Angeles have improved and simplified the load testing of Diesel engines on locomotives by an adaption of a piece of war surplus material shown in the illustrations—purchase price 25 cents.

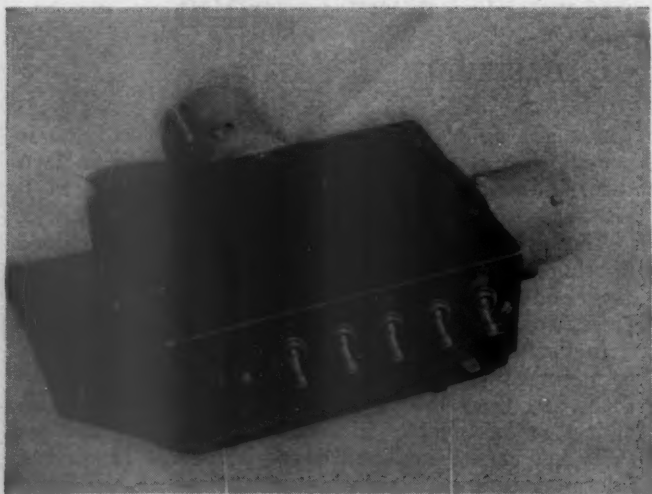
Load testing engines is accomplished by running the engine on various throttle settings and loading the generator on a resistance load. This is usually accomplished by three men—one operating the throttle, one making tachometer readings at the front end of the engine, and one operating the loading resistor or water rheostat. Communication between the man operating the throttle and those at the tachometer and rheostat is necessary and is also difficult.

The device illustrated permits control of the engine by the man who makes the tachometer readings. To use the device, the control cable is disconnected from its receptacle at the fuel rack relays and the device inserted in the circuit.

The receptacle on the long side of the device serves simply to connect with the 64-volt power supply. The other receptacle corresponds to the control receptacle which was disconnected.

By operating the toggle switches in different combinations, it is possible to duplicate all of the connections made at the throttle and operate the engine at any desired speed.

Testing is thus simplified and errors due to faulty communication are eliminated. Circuit connections inside the device were changed from their original form to meet the requirements of Diesel engine control.



Two views of the engine control device

Fruit Growers Express car equipped with Thermo King refrigerating and heating system

A Mechanical Refrigeration System for Cars

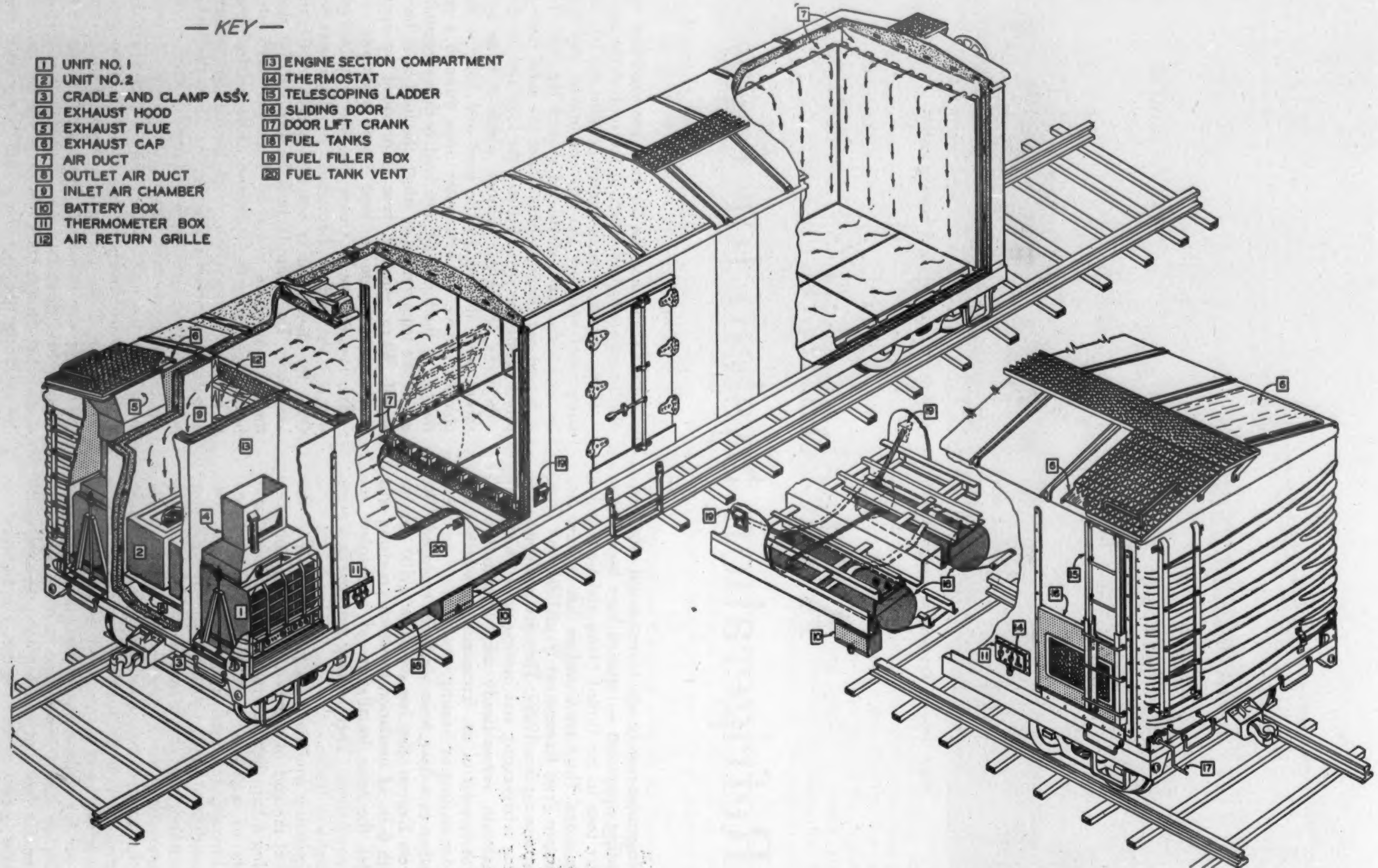
THREE refrigerator cars in which mechanical refrigerating and heating equipment is installed have been undergoing service tests in the United States and Canada for the past two years. These are Canadian National car No. 209661, Western Fruit Express car No. 67564, and Fruit Growers Express car No. 39897. They are equipped with Thermo King refrigerating and heating units which operate to maintain automatically any temperature for which the thermostat is set, irrespective of whether the demand is for cooling or heating.

Several other cars have been similarly equipped. The Fruit Growers Express also has on order 1,100 cars to be built with 6 in. of insulation in which provision will be made for the later installation of mechanical refrigerating equipment. Thermo King units are in service in 14,000 highway trucks.

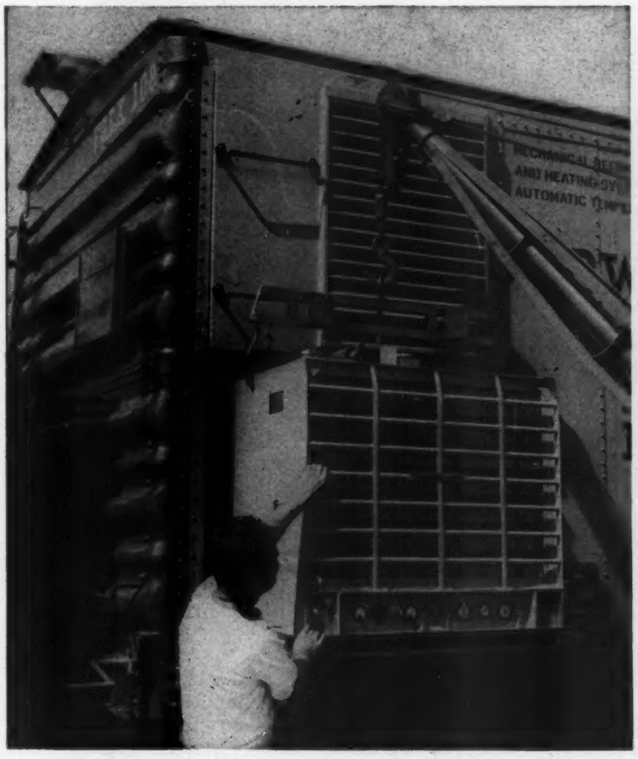
The refrigerating equipment occupies the space of the ice bunker at the end of the car. To insure unbroken service during a trip there are two complete units. Each unit consists of a 28-hp. gasoline engine, a direct-connected Freon compressor, a condenser and a generator mounted in a single housing, and an evaporator unit and motor-driven air-circulating fan. The engine and compressor units are placed one on either side of the end of the car and can be removed for replacement through a grill door in the side of the car. The unit is mounted on a rolling platform which is readily pulled out of the car for replacement of the unit and pushed back into the car with the new unit in place. Two connections—one for fuel and one for controls—are made before the unit is pushed into the car. The sliding door is closed by a crank applied in a socket in the end of the car. Closing the door also lowers a hood which carries the exhaust and hot air from the condenser up and out through a capped hatch in the roof of the car.

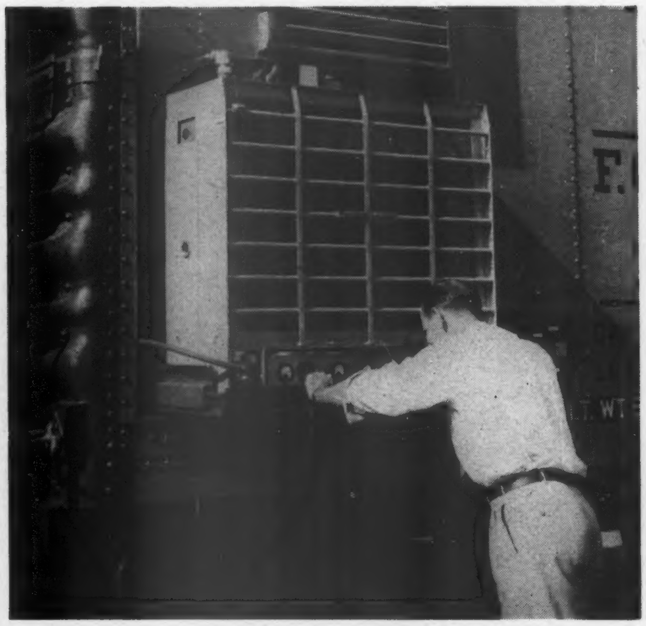
In an insulated compartment between the two engine-compressor units are the two evaporators and the fans by which the air is circulated around the load. The air is forced out through ducts under the solid floor which direct it into the space between the load and the end and side walls of the car through which it flows upward, thence over the top of the load and back to the air chamber above the evaporator units through a grill in the top of the bulkhead. The load is thus surrounded by air at the temperature at which the load is to be maintained. When required, heat is provided by operating on the reverse-cycle or "heat pump" principle.

The temperature to which the load is cooled and at which it is held is determined by thermostat setting. Once the thermostat is set, the control of the unit is automatic The controls include starting and stopping the set to meet the demands of the load for cooling or heating, changing the operation of the set from cooling to heating or vice versa, when the outside temperature drops below or rises above that for which the thermostat is set, and starting a battery-powered electric recirculating fan to prevent the development of uneven temperatures while the unit is off. During precooling periods both units are in operation. After the temperature of the interior of the car has been reduced to the thermostat setting, one unit shuts down and a single unit protects the load thereafter. The other unit then operates as a stand-by. It automatically takes up the load should the operating unit fail. Each unit is equipped with an automatic time-regulated defrosting device which goes ino operation every five hours.



The Thermo King mechanical refrigerating and heating system occupies a space of one ice bunker in the car, with fuel tanks and storage battery mounted underneath—The lading space is of the cold-wall type





Left: Placing an engine-compressor-condenser unit on the rolling platform—Above: With fuel and control connections in place, the unit is rolled into the car

The two units have a capacity of three tons of refrigeration at zero degrees F. One unit has sufficient capacity to maintain the temperature in the car at zero.

Two fuel tanks are located under the car. These are connected and can be filled from either side of the car. They have a combined capacity of 155 gal. Fuel consumption depends on the weather conditions and the duration of the trip from loading to unloading of the car. In general, consumption is heaviest during the summer months when the cooling load is greatest and lightest during the spring and fall when the load varies between light heating and light cooling.

A box on each side of the A end of the car contains thermometers and a system of signal lights which tell at a glance the operating condition of both units. These include indications of the temperature at the top and bottom of the load and the thermostat setting.

A development of interest to shippers was revealed at a press conference in New York on December 7 by Frederick McK. Jones, chief engineer of the U. S. Thermo Control Company, Minneapolis, Minn., manufacturers of the Thermo King equipment. This is in the field of humidity control that is expected shortly to enable shippers of such products as lettuce and strawberries to avail themselves of the advantages of mechanical refrigeration. It will eliminate top and body icing, and prevent slime, mold, wilting and dehydration.

This involves a system of dampers that seal off the cargo compartment and stop the fresh produce from "breathing." These dampers do not swing into sealing position until moisture brought out by the preliminary cooling process has been carried away. But once the product has attained the desired coolness, the "lid" goes on and the refrigerated air for the remainder of the haul is confined to the cold walls that envelop the load. To prevent stratification, a small auxiliary fan circulates air within the cargo space.

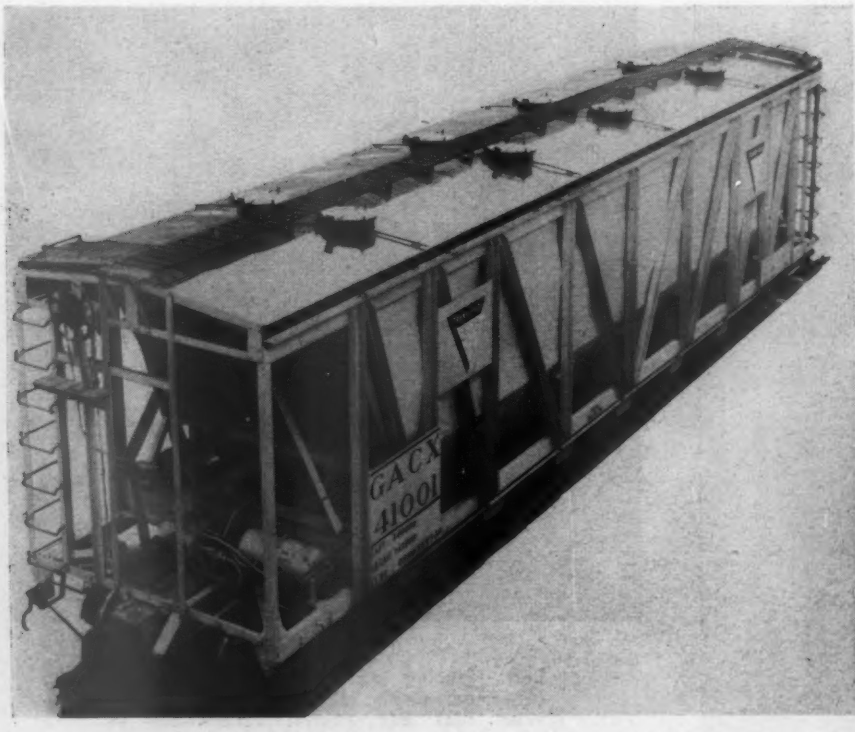
The humidity control device will eventually become a regular part of Thermo-King units for both railroad cars and trucks.

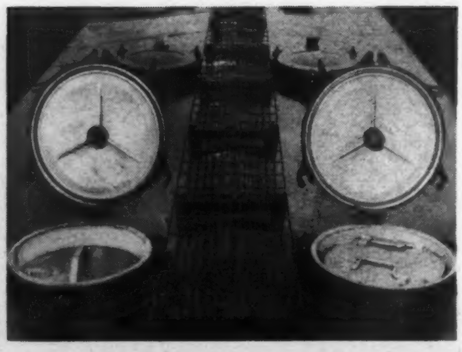
The service testing of the Thermo King equipment in refrigerator cars began late in 1948. The cars have handled apples, canned goods and frozen fish on transcontinental trips in Canada; and frozen meats, frozen concentrates, apples, oranges, and potatoes through all seasons in the United States on routes varying from less than 900 miles to over 3,000 miles. The temperatures of the loads at unloading have been uniformly close to the thermostat setting, and the condition of the lading excellent.

In one Canadian trip the mechanically refrigerated car carried 30,000 lb. of frozen halibut between Prince Rupert, B. C., and Montreal, Que., a distance of 3,000 miles during which outside temperatures ranged from 38 to 104 deg. F. This trip was made between June 23 and July 2, 1949, with an elapsed time of 206 hrs., during which 220 Imp. gal. of gasoline were consumed, including pre-cooling as well as demands during the trip. According to the Fisheries Research Board the temperature distribution in the car was better than is found in many cold storage rooms in which frozen fish is stored.

In a trip of 3,000 miles between Ontario, Cal., and New York, between October 12 and October 23, 1949, a load of oranges was delivered, the temperature of which ranged from 41 to 45 deg. F. When loaded, the temperature of the fruit averaged 73 deg. and the atmospheric temperature 95 deg. With the thermostat set at 45 deg. the product temperature was reduced to an average of 45 deg. in 12 hrs. 45 min. after the car doors were closed. The fuel consumption was 85 gal.

Experience with these cars indicates that maintenance, depreciation, interest, and the operating cost of the refrigerating equipment will average about 27 cents per hour of elapsed time in service. Units will be repaired at centralized points. Removing them from and replacing them in the car does not require skilled labor.





Right, top: Two loading hatches open while unloading, with filter and dummy filter in place. Bottom: Unloading nozzle on flexible stainless-steel hose is being connected to one of the hoppers.

General American Trans-Flo Car for Bulk Transportation

A covered hopper for flour, plastics and dry chemicals loads by gravity and unloads pneumatically with protection from infestation and contamination

THE TRANS-FLO covered hopper car, recently developed by the General American Transportation Corporation, Chicago, is especially designed for the sanitary and efficient bulk transportation of dry, granular or powdered commodities, such as flour, plastics, chemicals and pharmaceuticals. It is not intended for the shipment of materials normally handled without fear of contamination or infestation in conventional covered hoppers which can be unloaded by gravity, but, utilizing a pneumatic unloading system, it gives full protection to lading and extends the advantages of bulk handling to numerous commodities formerly requiring transportation in individual bags or packages.

About 25 of the new Trans-Flo cars are now in flour service and have demonstrated not only important savings in material and labor costs, but such advantages as greatly improved sanitation, freedom from infestation, higher capacity loads, reduced loading and unloading time, and elimination of damage claims. The car, slightly more than 55 ft. long over coupler pulling faces, has a nominal capacity of 140,000 lb.; light weight of 68,100 lb.; load limit of 141,900 lb.; cubic capacity of 3,150 cu. ft. in two welded stainless-steel compartments, supported in the car superstructure; 70-ton trucks; and Duryea double-cushion underframe.

The new car is the result of over two years of extensive research and testing by General American in close collaboration with the National Biscuit Company and the Fuller Company of Catasauqua, Pa. The investigation was conducted in a special laboratory built by General American at its plant in East Chicago, Ind. This laboratory is equipped with a full-scale section of a Trans-Flo car along with a Fuller Airveyor System, which is used to unload the commodity from the car. Thus, it is possible

to conduct demonstrations in the laboratory closely approximating actual conditions at the unloading site.

General Features

While the Trans-Flo is essentially a covered hopper car, it differs from the standard-type car in that it is composed of two large compartments (1,575 cu. ft. each), each having six sets of hopper-type bottoms. It has to be unloaded pneumatically and cannot be unloaded by gravity. A syntron electro-mechanical vibrator, applied to each hopper as it is being unloaded, assures a uniform flow of lading and overcomes any tendency for it to stick to hopper slope sheets. The entire unloading operation can be performed by one man in less than four hours.

Each compartment now has two loading hatches, although some have been built with four. Improvements in loading procedure have made the extra hatches unnecessary.

Trans-Flo cars are furnished on the basis of a 10-year lease. Because they are privately owned, railroads pay a mileage allowance for each mile that the car travels, either empty or loaded. This mileage allowance, in turn, is credited to the lessee's account, thereby reducing the cost of the car to the customer.

There are no mechanical moving parts in the car, thus eliminating the possibility of mechanical failure which would prohibit prompt unloading at point of destination. The cars may be loaded at the mill by gravity, by merely diverting the millstream into the car. An air-powered spinner has been developed which permits the car to be loaded within inches of the roof. This helps prevent condensation by keeping the air space between the top of the lading and the roof of the bin to a minimum. Condensation is said to be insignificant, summer or winter.

No Infestation or Contamination

Experience indicates that, in the bulk handling of flour by pneumatic equipment, the development of weevils and other internal infestation appears to be almost completely arrested.

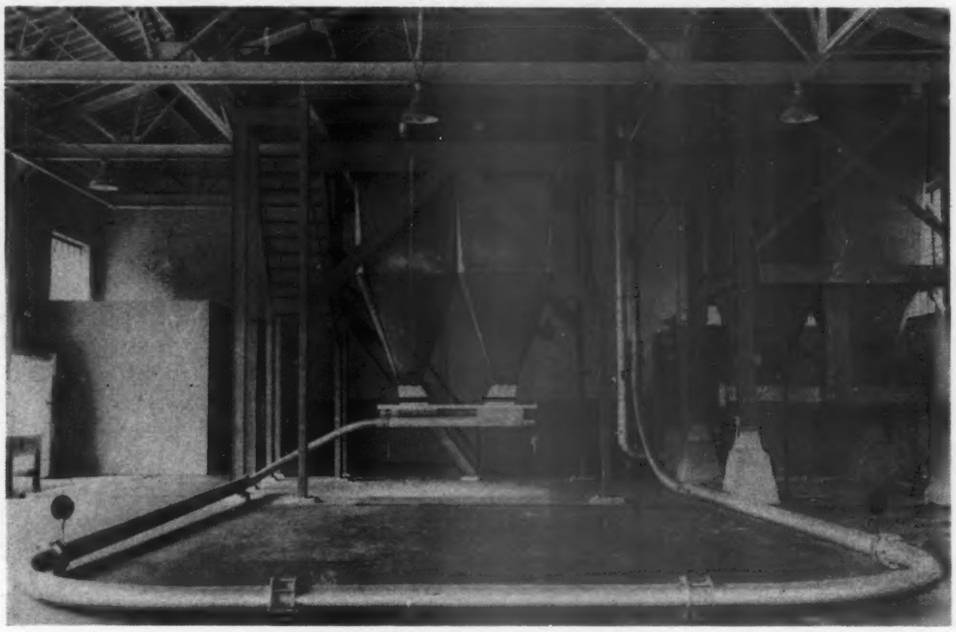
Contamination of the lading also is virtually impossible. For example, the roof hatches as well as the unloading nozzle assemblies have filters which prevent any outside contaminating substance from coming in contact with the lading during either loading or unloading operations. The interior welding is ground smooth to minimize the possibility of lading clinging to the welds, and the corners of the hopper bottoms are rounded.

When the car is being filled, the filter is attached to the hatch cover in such a way it cannot become contaminated. When the car is being emptied from the bottom, the hatches are opened and the filters prevent dust or contamination from coming into the car with the outside air.

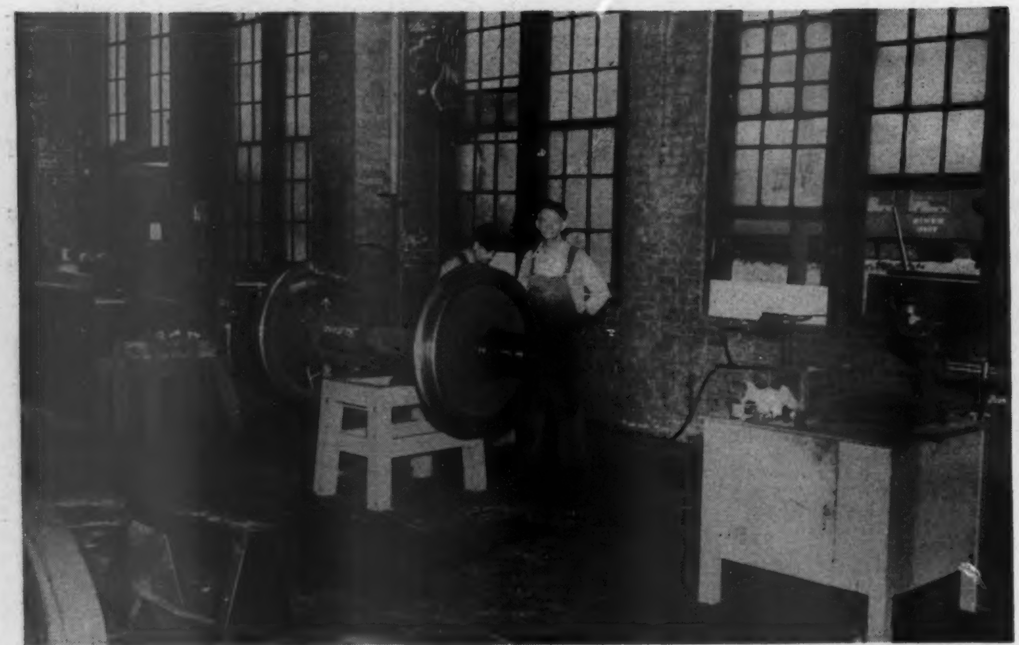
The hatches are also equipped with a channel to drain out water. As a consequence, the car can be safely emptied even during rain. In transit, the hatch covers carry a wire seal placed by the railroad, and there is no way of raising the hatch cover without breaking the seal.

At the point of consignment, the bulk car is spotted at the railroad siding and the Fuller pneumatic conveying system is connected via a flexible hose line to the nozzles on the bottom of the car. The valve gates are opened and the lading flows from the compartment into the nozzle, whence it is drawn through the pneumatic system to the storage bin, which may be either on the inside or outside of the bakery. Two cars may be unloaded by one man, using the pneumatic system, in an eight-hour shift. Bakeries which lack large bulk storage space within the plant may erect inexpensive storage facilities on the outside, which may be insulated and protected by the plant heating system and thus operate satisfactorily in all climates, through all changes of weather.

The pneumatic system of moving flour within the plant consists of seamless steel tubing with long-radius bends and machined companion flanges to form perfect joints. Stainless steel is used where necessary in the pneumatic filter and other mechanical parts to give smooth surfaces and prevent coating. All parts of the system may be opened for complete sanitary inspection. Since the new method is a conveying system it may be combined with mechanical equipment for completing the killing of insects and the destruction of eggs, and with equipment for removing foreign material from the flour stream.



General American laboratory installed at the East Chicago plant to solve problems such as the bulk handling of dry, granular or powdered materials in a railroad car



Roller-equipped wheel stand (left) — Small steel bench for babbit weighing and melting (right)

Car Wheels Dynamically Balanced at Burnside Shops

THE Illinois Central has recently installed equipment for the dynamic balancing of car wheels on a production basis at its Burnside (Chicago) shops. The production-line set-up, was developed by J. F. Monger, general shop superintendent and J. J. MacLeay, general car shop foreman at Burnside, in cooperation with the Bear Manufacturing Company.

Tinning the wheel for application of babbit metal to correct the unbalance

Experience with the dynamic balancing of car wheels at Burnside shops indicates that the average unbalance is between 2½ to 3 lb. per wheel, with a maximum of 5 lb. By means of the I. C. production line methods, wheels are completely balanced statically, as well as dynamically in an average of 20 min. per pair of wheels. About 6 to 8 min. are taken for the actual balancing operation, while the rest of the time is required to make corrections is done by applying the specified amount of babbitt metal permanently under the inside rim of each wheel at the indicated spot by tinning and soldering.

Dynamic Balancing Not New

The I. C.'s original interest in dynamic balancing first took place several years ago, with the installation of a Bear dynamic balancing machine at the Burnside Diesel shop. Dynamic balancing soon became a regular part of the maintenance routine. In the course of balancing such large rotating parts as main generator and traction armatures, maintenance records pointed out the time, labor and money-saving effects of dynamic balancing. As soon as the point was reached where armatures, other generator parts and air conditioning equipment were dynamically balanced regularly as a matter of routine, maintenance costs were reduced. A reduction in bearing wear was noticed, with consequent elimination of frequent "tear-down" jobs to replace worn bearings. The

life and efficiency of commutators and brushes were also increased, due to the elimination of vibration by dynamic balancing of the armatures.

Experimental Wheel Balancing

In the light of these results with armature-balancing, I. C. maintenance officers decided to do some experimental balancing of car wheels whenever there was a lull in armature-balancing activity. Changing over the set-up

The wheel rim is preheated lightly and uniformly throughout the entire circumference

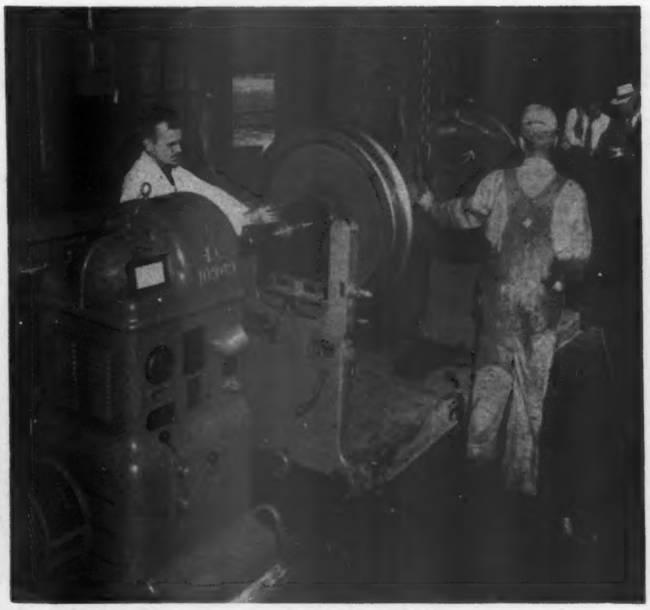
to accommodate a set of car wheels was a simple matter. Special flexing heads, equipped with adjustable roller bearings, made it possible to accommodate shafts of varying diameters. The distance between column supports, on the Bear machine, was adjusted to accommodate the greater length of the axle.

After many successful test runs and much research, the I. C. balanced all the wheels of its "Daylight Special," which runs on a mile-a-minute schedule between Chicago and St. Louis. Other balancing operations involved the wheels of several cars of the "City of New Orleans," as well as a number of specialty cars, such as observation-parlor cars, bar and lounge cars, diners, dormitory-tavern cars, mail and express cars, and power cars.

During this testing period, I. C. officials also found that, when Diesel locomotive wheels are dynamically balanced, higher-speed standards can be attained easier, and the trains perform better. Other benefits included savings in wear and tear on bearings and coaches in general, as well as on track.

Special Wheel-Balancing Set-Up

The results of experimental dynamic-balancing operations were so favorable, that the Illinois Central installed special wheel-balancing set-up in the Burnside car wheel shop. The operation is divided into three distinct phases, each being performed at a different station. The balancing machine, babbitt heater and scale bench and wheel-supporting stand, equipped with rollers, are located in one line along the shop wall with the wheel storage track just in front. The first operation is to lift the pair



Wheels in position on Bear balancer—Operator has started to lock axle to the flexing head

of wheels to be balanced with the shop crane and place it in the Bear machine where it is supported on flexible heads with adapters to suit axles of different diameter and also roller bearing races which do not have to be dismounted.

A safety hold-down is then clamped over the assembly which is revolved at the required speed, namely 325 r.p.m. for railroad wheels. An 1,800 r.p.m. motor and a four-speed transmission drives the machine which has a maximum speed of 1,000 r.p.m. A speed chart attached to the left top of the control tower specifies desired speeds for all railroad equipment parts likely to be balanced on this machine. A dial indicator on each support column indicates the amount of unbalance, and a round spark dial shows the position of unbalance.

The amount and location of unbalance in each wheel is obtained at one setting of the pair of wheels in the machine, after which this pair is released and moved by the shop crane to the wheel stand, shown, where they rest on rollers and may be readily revolved.

The first operation is to grind off all dirt and scale at a point under the wheel rim, as shown in one of the illustrations, where weight is to be added. This is done with a pneumatic hand grinder. The wheel is then revolved by hand while a gas torch is used to heat the wheel rim lightly all the way around. The spot where weight is to be applied is then carefully tinned, and revolved to the lowest point on the circumference. A piece of sheet asbestos backed up with thin sheet steel is then clamped to the inside vertical surface of the wheel rim.

In the meantime, an amount of babbitt metal equal to the unbalanced weight has been weighed out on the Fairbanks scale, melted by gas heating of a small ladle and poured into the prepared mold. When cooled this babbitt adheres firmly to the plate and underside of the wheel rim and, for all practical purposes, becomes a permanent part of the wheel.

The amount of dynamic unbalance in the wheel, illustrated, was 3 lb. 2 oz. and this amount of babbitt is shown applied to the underside of the wheel rim at the required spot to place this wheel in accurate dynamic balance.

Burlington Reclamation Practice at Eola, Ill.*

An important first step in welding malleable iron freight car journal boxes is through cleaning by burning off the oil and refuse at low temperature in the annealing furnace, which expedites sandblasting, permitting ready location of cracks. In building up the wedge seat surface and other areas subject to abrasion, a 3/8-in. bronze rod is used to provide a hard surface. Cracks and fractures are welded with a 1/4-in. bronze rod as it adheres to malleable iron and provides a strong weld

Out of many hundreds of items that are selected on a basis of definite savings as compared to the cost of new parts some car and locomotive parts offer opportunities to take advantage of modern welding technique

THE Burlington Reclamation Plant at Eola, Ill., occupies a floor space of 4,000 sq. ft., and employs 46 men, including 4 oxyacetylene welders and 7 arc welders. Included in the plant are a blacksmith shop, a tin shop and a machine shop. The plant is piped throughout for oxygen and for acetylene, the oxygen being served by a cascade of cylinders and the acetylene generated.

Parts to be reclaimed are shipped into the shop from the entire system. The sorting of materials received, and the decision as to what to reclaim, is the responsibility of the reclamation plant employees. While much reclamation is performed that does not require welding, the number of parts reclaimed by welding for the mechanical and other departments is about 175.

All reclamation of material is done on orders approved

* Abstract of a paper presented before the American Welding Society by W. G. Muschler, superintendent reclamation and scrap, C. B. & Q.

The amount of weld metal deposited is controlled accurately to minimize the grinding required. After completion of the dust-guard surface grinding, the box is ready for service with a saving of approximately 75 per cent of the purchase price

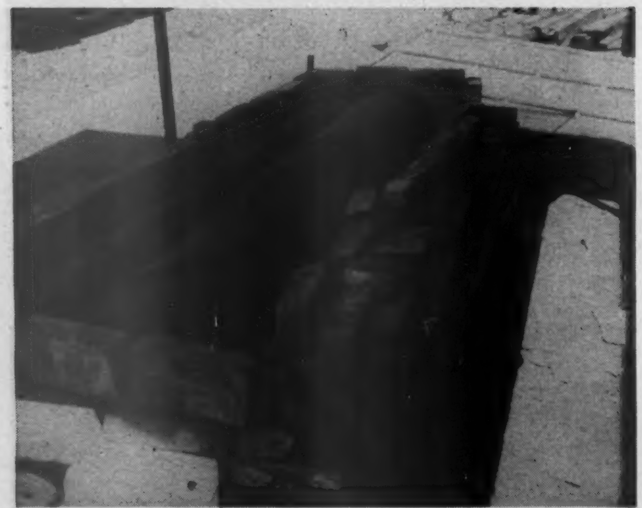
Oxyacetylene heating of a T-section for a warehouse truck preparatory to making a bend. T-section is 5/16 in. by 3 in., and the bend is heated in 15 seconds with a No. 80 tip

Left: In building the warehouse trucks it was found economical to weld up small sub-assemblies. The front swivel wheel assembly is shown in the jig ready for welding.—The back wheel assembly is made on the same jig. Right: Smooth welds which require no after finishing are obtained with the above procedure for welding 1-in. pipe for the end gates on the warehouse trucks. The jig for the operation is underneath the pipes being welded. A No. 40 tip is used with a 3/16-in. mild steel rod

Above: Arc welding the base members of a warehouse truck frame on a special holding fixture, using E-6012 ¼-in. electrodes—Below: The all-welded warehouse truck, assembly procedures for which were shown in Figs. 3, 4, 5, 6 and 7, prior to spray painting and application of the wood deck floor

Above: The bend is made in the T-section by hand while it is red hot on the jig shown above—Below: Because building up worn surfaces of truck bolsters is permissible if the material remaining in the part is 60 per cent of the original section, and because there are no restrictions on welding cracks or fractures, a saving of 94 per cent is realized. The bolsters are built up with 3/16-in. and ¼-in. electrodes. Cracks and fractures were welded with ¼-in. E-9010 electrodes, providing a tensile strengh of 112,000 lb.

Left: Diesel wrist-pin bushings are de-silvered by placing the bushing in a cast-iron ladle and playing the acetylene flame from a No. 80 tip on it. The silver melts and flows into the ladle. Right: The molten silver is poured from the ladle into a sand mold that furnishes 16 round slugs of 99.9 per cent purity, the silver on one bushing making one slug. Also shown is one of the slugs sawed in half



This cable drum for a gantry crane weighs 1,550 lb., is 14 in. in diameter, and 90 in. long with a grooved area extending 36 in. The decision to weld it was reached because it was too valuable to scrap, and replacement with a new drum would cause serious delay. Welding required a mild preheat of 700 deg., and the depositing of 215 lb. of 1/4- and 3/8-in. cast iron rod with a No. 80 tip. The saving was approximately 75 per cent

by the using department, or, if for stock, by the storekeeper. Material is not reclaimed in advance of properly approved order, nor merely to keep the plant busy.

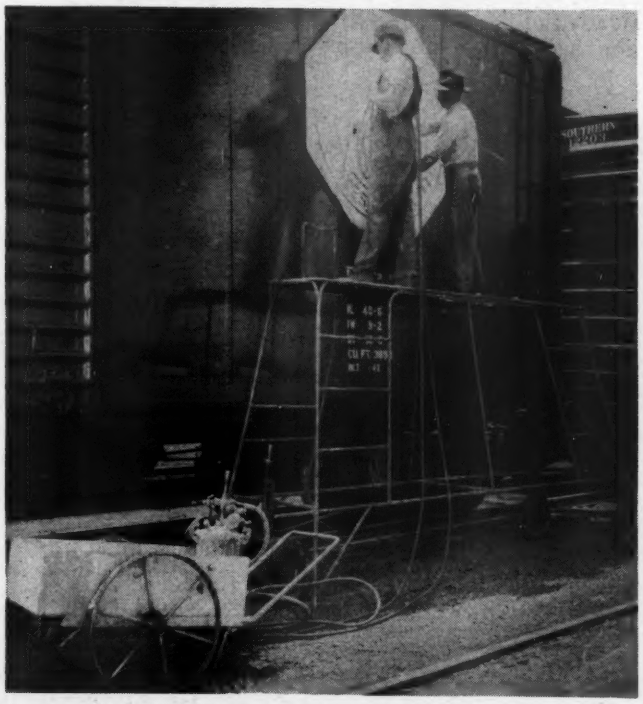
Certain general practices are common to all operations. In all possible operations the work is positioned to permit downhand welding. Annealing, normalizing or stress relieving is done at a temperature rise rate of 500 deg. per hr., and then held at the specified temperature for one hour per inch of thickness. Annealing temperatures are 1,500 to 1,600 deg. F., and the material is allowed to cool to 500 deg. or below in the annealing furnace. Normalizing is done within the same temperature range, but the material is removed from the furnace and allowed to cool in still air with protection from drafts and weather. Stress relieving is done between 1,200 and 1,250 deg., and the material cooled in still air.

The illustrations show some of the operations at Eola, and the fixtures on which they are performed.

Building up a brake head in a turning jig with a No. 60 tip

Left: Brake heads are built up by welding, and bored out. Center: The ends of brake beam compression members built up with oxyacetylene, the rod used being 1/4-in. No. 1 rolled steel. Right: Outside circular cutting tool devised for turning the built-up ends of brake beams to proper dimensions

Car Stenciling Portable Scaffold



Portable scaffold for stenciling box cars

A portable scaffold has been built at the Spencer, N. C., shops of the Southern primarily for stenciling box cars. The scaffold is 6½ ft. high and rides on three pneumatic rubber tires 4 in. by 15 in. The rear tires are fixed while the front tire swivels and can be lowered for movement or raised for securing the scaffold in working position, the raising and lowering being done with a screw handle. When the front wheel is raised the scaffold rests on the two back wheels and on two front legs.

The platform is constructed of $\frac{1}{16}$-in. plate, with the frame structure of ¾-in. pipe, and the steps and braces of ½-in. pipe. The wheel casters are ⅜ in. by 1½ in. Two other scaffolds used for similar work at lower locations are similarly built; one is 5 ft. high and the

Wheel Handling Using Elevated Runway

An elevated runway forms an integral part of the wheel handling system of the Grand Trunk Western's Port Huron, Mich. shops. The mounted wheel sets enter the

New wheels enter the shop along the runway at the right—Along the left is part of the wheel storage area which occupies the space between the runway at the right and the elevated runway for the incoming mounted wheel sets

Elevated wheel runway with elevator which automatically lowers one pair of wheels at a time to a demounting press just beyond the end—To the left of the main elevator is a small hoist for moving demounted scrap wheels out of the shop along a runway for single wheels—The reconditioned wheel sets are rolled out of the shop on a floor-level track directly underneath the elevated runway

shop on the elevated runway and proceed to the far end where a trip releases one pair of wheels at a time. These are lowered by an elevator and rolled to a demounting press just beyond the end of the runway. Demounted scrap wheels are returned to the end of the runway and elevated by a hoist to a wheel runway on which they run by gravity out of the shop. The axles go to a rack on the side of the demounting press away from the runway. Reconditioned wheel sets move out of the shop on a floor-level track directly underneath the elevated runway.

New wheels enter the shop on another single-wheel runway along the wall, the space between this latter runway and he other two runways serving as a storage area for wheels. The new wheels are unloaded directly onto the chute from the car over a platform at the loading end of the chute at the level of the car floor. The two single-wheel runways have adjustable retarders to control the speed of the wheels.

Strengthening Gondola Top Bulb Angles

Gondola car on which the top bulb angle has been reinforced to prevent sagging and buckling

The top bulb angles on Mill-type gondola cars are being reinforced at the Nickel Plate Road's Conneaut, Ohio, shops to prevent them from buckling or breaking, a defect common to this type of equipment. The angle is stiffened against vertical as well as horizontal stresses by the reinforcement which extends from bolster to bolster and more than doubles the strength of the top chord against both vertical and horizontal loads. The reinforcement also indirectly strengthens the side sills and the center sill.

When existing bulb angles are removed, straightened and reapplied, a section of bar iron 1 in. by 4 in. is applied to the top of the bulb angle from bolster to bolster. The bar is tapered at the ends in order to avoid setting up abrupt stress points. Attachment is made by plug welding through ¾-in. holes in the center line of the bar, spaced 5 in. apart, and by riveting at intervals approximating post spacing.

When new bulb angles are applied, a section of bar iron ⅝ in. by 4 in. is used, and on top of this bar an angle ⅜ in. by 3½ in. by 5 in. is applied with the 5 in. leg horizontal. Both sections extend from bolster to bolster, and attachment is made as outlined above except that an additional row of holes is provided in the horizontal leg of the angle which is plug welded to the outside leg of the bulb angle. The car shown in the illustration has been reinforced in this manner.

Distributing Oil Evenly in Waste

The risk of dumping back in one spot all the oil that settles out of journal packing waste during storage is averted by an arrangement used at the Despatch Shops, Inc., East Rochester New, York. The packing is placed in one of two steel bins 8 ft. wide by 3 ft. deep by 2½ ft. high. The oil whch settles out of the waste drains into two clyinders 6 in. in diameter and 8 ft. long. These clyinders are mounted on a slight incline with one end 4 in. higher than the other.

Air pressure is applied directly to the high end of the cylinder and forces the oil into a rubber hose which is attached to the low end. The discharge end of the hose is fitted with a spray nozzle, and it is thus a simple matter to spray the oil evenly over the entire top of the waste contained in the bin.

The waste is first saturated in an adjacent oil house

Arrangement for evenly distributing the oil which settles out of stored waste

and carried to the oiling room in barrels. It is placed in bins for overnight storage at 100 deg. Before packing is begun in the morning the top layer of the waste is sprayed, allowed to stand about 15 min., and formed into rolls. The waste is sprayed throughout the day between the packing of each set of four journals on each truck.

Full-line air pressure is available at the control valve for spraying the oil, but the valve is only cracked about $1/16$ of a turn. A globe valve is incorporated between the drainage clyinders and the waste storage bin. This valve isolates one from the other when the air pressure is on during the spraying operation, and prevents dissipation of the air pressure through the bin.

Altitude Performance of Electro-Motive Model 567 Engine*

The results of tests made to determine the tractive force available for traction at varying elevations from 500 to 10,000 feet

By H. W. Barth†
D. M. Lyon† and
R. B. Wallis†

THIS PAPER is presented to describe certain tests of the General Motors 16-567B diesel engine, performed by the Engineering Department, Electro-Motive Division, General Motors Corporation. The primary purpose of the tests was to study the variations in horsepower available for tractive force as affected by altitude and temperature conditions.

The General Motors 16-567B is a 16 cylinder, 8½-in. x 10-in. uniflow, two stroke cycle, 45 deg. V engine. It is centrally mounted in the Model F7A locomotive and is directly coupled to the main generator. Fastened integrally to the main generator shaft is an alternator which supplies the power for radiator cooling fans and traction motor blowers. The output of the main generator in normal operation is entirely absorbed by the four axle hung traction motors. Mounted on top of the main generator and driven from an additional power take off from the engine timing gears is an auxiliary direct current generator for battery charging, field excitation, and controlled power. Coupled to the rear end of the main generator is the locomotive air compressor. All of these power absorption units are fixed to rotate whenever the engine is running and are loaded or not as required by their specific duties. The engine operates at a given speed and fuel rate for each of the eight positions of the operator's throttle. The speed and fuel rate are pre-set in the engine governor adjustments and a regulator adjusts the engine load to utilize the power available at these settings. Thus, the fuel supplied under fixed throttle conditions remains constant regardless of the load demands of the locomotive auxiliaries or the draw bar.

The Model F7A on which this engine was installed is a single locomotive lead unit. It was complete with cab and all operator's controls and may be used in service alone or in conjunction with additional units. Prior to the time that any engine tests were made, it had been operated for approximately 20,000 miles for the purpose of experimenting with the electrical switch gear. This period permitted a good shakedown of the engine and allowed time for the running in of all parts.

The principal study of variations in horsepower as affected by altitude required tests at 10 sites ranging in geographical altitude from 500 to 10,000 ft. in 1,000-ft. increments. The test sites in order of their elevation were: the Electro-Motive plant, La Grange, Ill.; Parsons, Kan., on the Missouri-Kansas-Texas; Hastings, Neb. and Wray, Colo., on the Chicago, Burlington & Quincy; and on the Denver & Rio Grande Western, Denver, Colorado Springs, Salida, Buena Vista, Granite, and Tennessee Pass, all in Colorado.

Plans were made to control as many variables as possible. The first problem was to keep the locomotive stationary, and thus at a fixed altitude, during the test runs

* Abstract of a paper presented at the Society of Automotive Engineers, National Diesel Engine meeting, Chicago, November 2 and 3, 1950.
† Electro-Motive Division, General Motors Corporation.

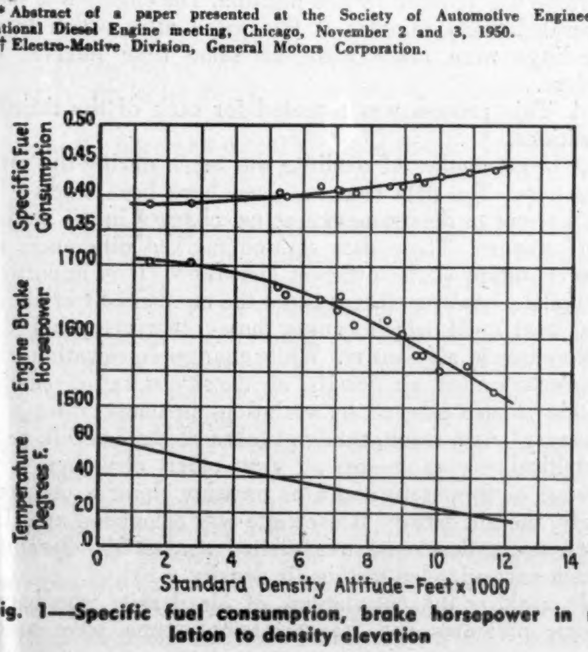


Fig. 1—Specific fuel consumption, brake horsepower in relation to density elevation

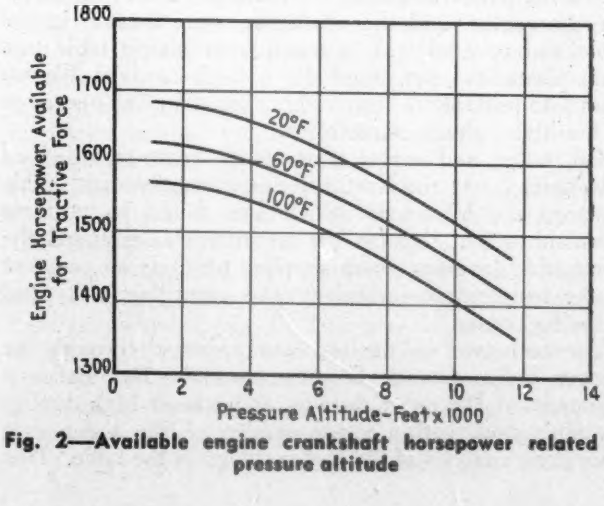


Fig. 2—Available engine crankshaft horsepower related to pressure altitude

E.M.D. F7A locomotive A unit, fuel tank car and engineering test car at Tennessee Pass, Colorado

at each site. Since the traction motors cannot absorb the full energy output of the engine while the locomotive is stationary without overheating, the output of the main generator was connected to the resistor grids of the dynamic brake hatch. These grids, which are part of the locomotive's regular braking system, are of ample capacity to dissipate the full power output of the engine in the form of heat.

The second problem was to provide uniform fuel for the tests. The locomotive fuel tank had not sufficient capacity to carry the fuel required for all the tests. To provide uniform fuel a tank car was coupled to the locomotive. Fuel for all the tests, providing data for this report, was drawn from this tank car.

All instrumentation was incorporated in a test panel within the locomotive car body. A photograph shows the pressure gauge panel, the exhaust temperature indicator, and the fuel scale and timing equipment by which the fuel rate was determined. The exhaust temperature indicator was a 40-point Leeds and Northrup Speedomax Indicator. The fuel weighing device consisted of a 125-lb. platform scale supporting an 18 gal. fuel tank. The beam of the scale was equipped with a mercury switch which closed at the beginning and ending of a weigh period. This switch operated relays which started and stopped a 1/100th min. timing clock. Electrical meters, used to indicate the power output of the main generator, the auxiliary generator, and the alternator, were located in the table and covered with a transparent plastic table top. This plastic top permitted the use of standard Weston Model 45 portable meters, without exposing the operators to the high voltage connections.

Oil, water, and engine temperatures were recorded on a 16-point Leeds and Northrup Speedomax recorder. This replaced the Micromax which was found to perform unsatisfactorily. Beneath the recorder was mounted the electronic converter which supplied 60 cycle a.c. current to the temperature indicating and recording units and to the fuel timer.

The fuel used on the test was procured through the Denver & Rio Grande Western from the Bay Refinery Company of Denver, Colorado, and was of high quality paraffinic stock with a cetane number of 59. A complete laboratory analysis of the fuel is shown in the table. This fuel was cleaner, higher in cetane number, and lower in sulfur than the majority of fuels currently used in railroad service.

The general procedure at each test site was similar. After the locomotive had been placed on a siding, the elevation of which was as close as possible to that called for by the pre-determined altitude schedule, operating checks were made of the engine and equipment before any data were taken.

The test at each site was designed to determine the engine horsepower in each of the eight throttle positions at the altitude at that site. The steps taken were as follows:

1. The engine was operated at full power for one hour to bring it to an equilibrium condition.
2. Readings were then taken of the power output, fuel rate, and principal temperatures and pressures. Second and third readings were made ten and twenty minutes later, respectively.
3. After completing the third full power readings, the throttle was reduced by one position. The engine was then operated thirty minutes at this speed after which three readings were made with the same time interval as before.
4. This process was repeated for each of the throttle positions.

A large number of readings was taken during the various tests. The data thus collected have been studied in an attempt to determine the actual changes in the engine performance. These data showed marked differences in power output at the different elevations. It is important to realize, however, that it is not the number of feet above sea level itself which causes these differences, but the differences in air density. While changes in elevation will themselves affect air density, air density at any given elevation is also affected by variations in temperature and pressure. As a result, readings taken at the 1,000-ft. geographical elevation—or at any other elevation—will change as temperature and/or pressure changes. Accordingly, the air density at each site was calculated and the horsepower developed was plotted against an elevation which corresponded to this air density.

In making the calculations of air density, the barometric pressures and free air temperatures were used.

Standard density altitudes were based on standard elevation pressures and a uniform temperature lapse rate of 59 deg. F. for sea level minus 3.566 deg. F. for each 1,000 ft. in elevation. Where the pressure altitude is accompanied by a temperature which is equal to the lapse rate temperature, the pressure and density altitudes are equal. The bottom curve in Fig. 1 shows this lapse rate temperature. The significance of using the air density as a measure of altitude is shown by the fact that Tennessee Pass, which is 10,424 ft. above sea level, had, on the day the test was performed there, a density altitude of 11,600 ft.

The middle line of Fig. 1 shows the curve that resulted from plotting the horsepower in relation to changes in density altitude. This curve represents total brake horsepower and includes the power required for the various locomotive auxiliaries as well as the power available for tractive force.

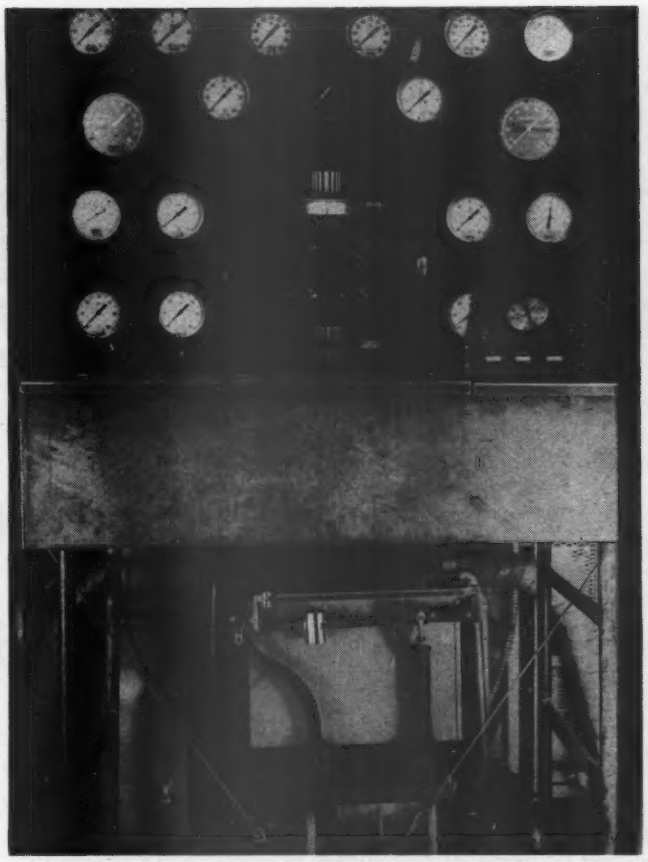
The curve indicates that there was practically no change in horsepower from sea level to 2,500 ft. Between 2,500 and 5,000 ft. a decline in horsepower became evident. It reached a rate of decline of about 20 hp. per 1,000 ft. for this 16-cylinder engine at altitudes above 5,000 ft. At any elevation additional fuel would give additional horsepower. This additional horsepower, however, is not proportionate to the additional fuel supplied.

Diesel Fuel Analysis—Fuel Used on E.M.D. Locomotive No. 930 During Horsepower Study—(Sample No. 0-3140)

Method of test	E.M.D. result
A.P.I. gravity at 60 deg. F.	38.5
Specific gravity at 60 deg. F.	0.832
Weight in lb./gal. at 60 deg. F.	6.93
Flash point, deg. F.	175
Conradson carbon (10 per cent Resid.) per cent	0.04
Viscosity at 100 deg. F., Saybolt Universal, Seconds	38.0
Viscosity at 100 deg. F., Kinetic	3.65
Acid and base number	0.00
Aniline Point, deg. F.	177
Bromine number	1.7
Specific dispersion	116
Thermal value, B.t.u. per lb.	19,750
Cetane number	59
Diesel index	68.5
Total sulfur, per cent	0.09
Copper strip corrosion test, at 212 deg. F.	Neg.
Cloud point, deg. F.	+25
Pour point, deg. F.	+5
Water and sediment, per cent	None
Color (union)	(Pink)
Ash, content, per cent	0.00
Gum content, mg. per 100 c.c.	63
Thermal value	
B.t.u. per gal.	135,750

The top line in Fig. 1 represents the specific fuel consumption in relation to the density elevation. The specific fuel consumption is a function of the brake horsepower output. It began at La Grange with .385 lb. per brake horsepower hour and reached .435 lb. per brake horsepower hour at Tennessee Pass. Since the weight of the fuel injected in pounds per hour remains constant for a given throttle position, the change in specific fuel consumption is inversely proportionate to the change in horsepower.

Figure 2 is composed of three curves showing engine crankshaft horsepower available for tractive force as related to the pressure altitude. These curves show the horsepower which was available in the test locomotive and should be adjusted to rated horsepower for applications to other locomotives. Since these curves are for constant temperature and are parallel to each other, the expected horsepower for a locomotive under any particular pressure altitude and temperature conditions may be determined.

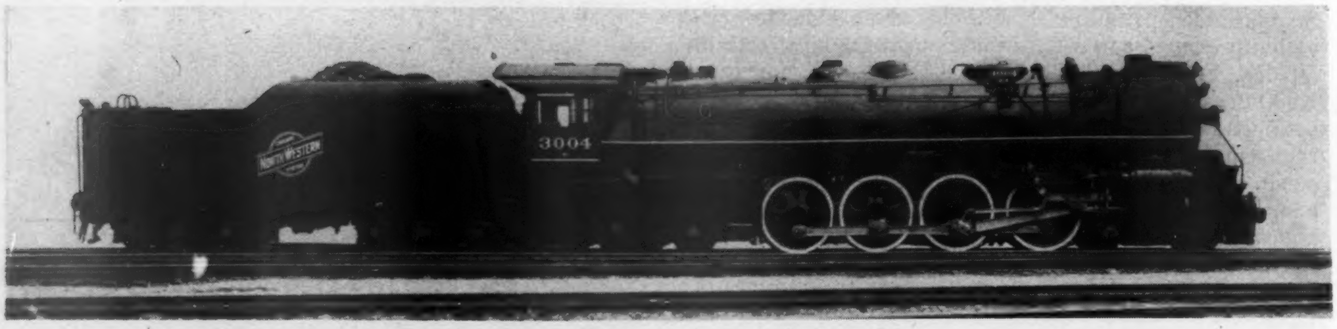


Test panel in locomotive includes pressure gauges, exhaust temperature indicator, fuel scale and timing equipment

Some information was obtained in the tests in addition to that presented in Figs. 1 and 2. It was observed that the heat rejection in the exhaust gases remained nearly constant at all altitudes. This was accompanied with an increase in the average exhaust temperature from 800 deg. F. at sea level to 1,000 deg. F. at the maximum altitude. In this particular engine, the heat rejection of the exhaust amounted to about 70,000 B.t.u. per min. There appeared to be a slight increase in the heat rejection to the cooling water between the low and high altitude extremes. The rejection was 56,000 B.t.u. per minute at La Grange and 63,000 B.t.u. per minute at Tennessee Pass. There was an indication of a slight increase in the heat rejection to the lubricating oil. However, the change in temperature recorded was within the error of the recording instrument and, therefore, will not be considered significant in this report. The heat energy converted to work amounted to 73,000 B.t.u. per minute at La Grange as against only 65,000 B.t.u. per minute at Tennessee Pass. This is a decrease in the thermal efficiency from 33 to 29.4 per cent.

Three cooling fans were required for all full load power runs even when the high altitude outside temperatures were as low as 32 deg. F. This may be explained by the decrease in the mass rate of air handled by the fans under high altitude conditions. The air box charging pressure of the engine declined from 7.6 in. to 6.36 in. of mercury. The ratio of these two pressures indicates that the air

(Continued on page 70)



North Western locomotive 3004 which has covered over 360,000 miles without shopping with the machinery still in excellent condition and suitable for at least one more year's service

Transit-Aligned Steamers Need No Shopping After Four Years

THE Chicago & North Western locomotive 3004, the first of the Class H heavy 4-8-4's to be modernized completely and laid out with a transit,* has recently undergone its fourth annual inspection after accumulating over 360,000 miles, mostly in freight service. During this entire period the locomotive has neither received nor required any classified repairs. The machinery is still in excellent condition and suitable for at least one more year of service. Some of the outstanding wear records of this locomotive and others of its class, no small part of which is due to the precision layout made possible by the transit, are given below.

* For complete description of the transit method procedures and results see Railway Mechanical Engineer of Dec. 1949, page 713.

Tire life on the first set of tires was 180,122 miles, on the second, 150,228. The third set was put on Jan. 20,

The beginning of good performance and high availability—The above view of the transit in the pit is the first step in this accurate layout method

1950 and has over 40,000 miles. The tires are still a full four inches with no flanging and only 1/16-in. tread wear. Mileage between Lidgerwooding has been as high as 115,-348. Some of the other H-1's have gone as high as 225,000 miles on a set of tires.

The cylinders on the 3004 and all other H-1's still use 27-in. packing; no cylinder boring has been necessary on any of the 23 H-1's. Most H-1's still use the original size 14-in. valve packing. The 3004 has just recently had 14 ⅛-in. packing applied. As the maximum size permitted is 14-⅜ in., no valve bushing difficulties are anticipated.

Both the valve guides and the main guides are still in good shape. The valve guides still have a 1/16-in. shim. The main guides are in excellent condition and are expected to last for many years. The crossheads are re-babbitted annually as a matter of course.

All original shoes and wedges are in use on all H-1's, and the same is true of the floating plates on the No. 1 and No. 4 drivers. The 3004 and one or two of the other highest mileage H-1's have had ⅛-in. oversize floating plates applied to the No. 2 and No. 3 drivers. Three new crank pins have been applied to the 3004, both No. 1's and one No. 4. The main, the No. 3's, and the one No. 4 were those originally applied in 1946 and are still in satisfactory condition. Most H-1's still have all original crank pins.

A crank pin witness groove is cut in the wheel hub about 1½ in. out from the surface of the crank pin. This witness groove is cut by the quartering machine in the back shop when the wheels were turned and pins quartered at the time the locomotive was modernized. The witness groove locates accurate quarter on each wheel and is used in setting the portable crank pin grinders and turning machines when truing of pins is required by enginehouse forces.

One steel rod bushing, the right No. 4, is the only recorded replacement in four years of service. Bronze bushings are replaced as wear develops but do not generally need attention between annual inspections. The motion work is in excellent condition, with no appreciable wear, no pitting or grooving.

The silico-manganese coil springs used at the front of the front drivers and at the rear of the rear trailer wheels are still in good condition and none have required renewal. Lateral difficulties are virtually non-existent. The H-1's are given ½-in. free lateral on the front drivers. The 3004 with over 360,000 miles has only ⅝-in. lateral. The only maintenance required has been to renew lug liners.

One of the outstanding characteristics of the H-1 locomotives has been the almost complete absence of flanging. This is attributable to two principal factors. One is the precision alignment attained with the transit layout and the second is a procedure followed at each annual inspection. The latter consists of dropping and dismantling the engine truck to inspect and repair the rockers and rocker seats.

The only machinery repair of any consequence made to the 3004 has been the application of the oversize floating plates at the No. 2 and No. 3 drivers. The only time any wheels were dropped on any H-1 was to renew lug liners; tires are shrunk on with the wheels in place and are turned by Lidgerwooding.

Flue extensions to 5 years of service have been granted the first two Class H-1 locomotives to complete 4 years of service. Plans are to request flue extensions for each H-1 as it completes 4 years of service.

A permanent exhibit of scale models of car couplers at the offices of the National Malleable & Steel Castings Co., Cleveland, Ohio. The history of coupler developments is traced from pre-Janney days down through the various steps in vertical-plane coupler development to present-day standards. Examples of the Millerhook and the link-and-pin types are also included.
Car coupler history

Diesel Engines or Gas Turbines For Locomotives*

Author contends there is not yet sufficient factual evidence to establish fact that the gas turbine is or will be more economical or attractive for general railway use than the diesel.

By N. C. Dezendorf†

LET us consider known facts in relation to the diesel-electric locomotive and compare them with the rather optimistic guesses being made for gas-turbine-driven motive power.

As to locomotive weight, adhesion imposes a natural and positive limit to the amount of horsepower it is worthwhile installing on any given weight of locomotive. If the unit is to operate on a comfortable margin of adhesion without the wheels slipping, the maximum tractive force should not exceed approximately 20 per cent of the locomotive weight on drivers.

From considerations of the maximum ruling grade (generally of the order of 2 per cent) and the relation between the speed on the maximum grade and the speed on the level, which are basic factors, there is no advantage for general-purpose railway use, in reducing the locomotive weight below 150 lb. for each horsepower of prime mover measured at the wheel. Locomotives designed specifically and only for high-speed passenger applications can, with advantage, have a higher horsepower per unit weight, but such applications represent a relatively small percentage of total railway operations.

It is typical of current standard designs of diesel-electric locomotives that the diesel engine prime mover represents approximately 15 per cent of the total locomotive weight. The General Motors two-cycle engine, which is the most widely used in the world, on a typical 1,500-hp. locomotive, weighs only 30,000 of a total locomotive weight of 240,000 lb. There is little merit, therefore, in the potential lighter weight of the gas turbine prime mover since, even if such weight reduction can be achieved, it is of doubtful value for general-purpose locomotive use.

Largely offsetting any potential reduction in the weight of the prime mover is the increased weight of the fuel required due to lower efficiency. A typical 1,500-hp. diesel locomotive has a fuel tank of 1,200 gal. capacity. Including the weight of the tank, this corresponds (at 10 lb. per gal.) to 12,000 lb. total. For the same mileage the corresponding tank with fuel on a gas turbine locomotive must weigh 28,000 lb., an increase of 16,000 lb. This weight, too, is variable which in turn creates adhesion problems.

Initial Cost

On a typical locomotive, the cost of the diesel engine prime mover represents only about 20 per cent of the total locomotive cost. Any saving, therefore, in the cost of the prime mover will affect only a small proportion of the total locomotive cost. If the cost of the power unit were halved, the cost of the complete locomotive would, therefore, only be reduced by 10 per cent. It is perhaps noticeable that claims for such reduction in cost have rarely been made by manufacturers who have built either type.

Since the prime mover represents a relatively small proportion of the total cost of the locomotive, the annual debit for depreciation and interest on capital is not likely to be greatly different for either a gas-turbine or a diesel-electric locomotive.

Cost of operation

According to well-established accounting practices, railroads customarily include engineman's wages, fuel, lubricants, other supplies, repairs, and enginehouse expense, in the cost of locomotive operation. For the purpose of this comparison, the significant elements of cost are fuel, lubricants and repairs.

In order to make a fair comparison, it is necessary to predicate a size of locomotive unit.

Currently and for several years past, the most popular diesel locomotive unit built and purchased in the United States is a four-axle, 1,500-hp., 230,000-lb. locomotive unit, suitable for general traffic use, but in particular for the class of freight service which constitutes the bulk of the traffic of U. S. railroads. Such a unit is normally used coupled 2, 3 or 4 in multiple, giving 3,000, 4,500 or 6,000 hp., respectively, controlled from one operator's cab.

Potential high power output from gas turbines may encourage the development of gas turbine locomotives having powers higher than 1,500 hp. per unit. There is at this time no clear reason why such units should be more economical either to build or operate, except for some special applications such as high speed passenger work. Accordingly, for our comparison, we select a 1,500-hp., four-axle, 230,000-lb. general-purpose locomotive.

Fuel Costs

As presently developed, all gas turbines are operating either on gas or liquid fuels, but there is substantial interest in the use of coal in gas turbines. Assuming a satisfactory and reliable piece of equipment, the use of

* Conclusion of a paper presented in a round-table discussion at the Pan American Railway Congress, Mexico City, October 10 to 20, 1950. Mr. Dezendorf credits H. G. McClean, export manager of Electro-Motive with assistance in the preparation of this paper.

† Director of sales, Electro-Motive Division, General Motors, LaGrange, Ill.

the gas turbine will be dictated, in large measure, by its economy. This is normally a combination of thermal efficiency and the unit cost of fuel.

There are places where the relative cost of coal fuel and oil fuel give substantial advantage to the former. This has, naturally, inspired attention to and research in the production of a coal-fired gas turbine. Additional and substantial engineering problems are involved as it superimposes on the problems of the gas turbine itself, difficulties in powdering the solid fuel, removal of objectionable material such as grit, and keeping the temperature down so that fly ash will not melt and form a slag on the turbine blades. Experimental work on the coal-fired gas turbine is presently being undertaken jointly by a group of American coal interests and locomotive builders, and also by Brown Boveri in Switzerland.

It may be noted, however, that on the basis of both availability and cost, the differential between coal and fuel oil appears to be moving in favor of liquid fuel. Accordingly, in the following study, it is assumed that the gas turbine will operate on oil fuel.

The General Motors 567-B diesel engine, so widely used in U. S. locomotive applications, has a thermal efficiency at full load of not less than 35 per cent and this efficiency is sustained over a wide range of loads. The efficiency of the electrical transmission will be substantially the same for either diesel or gas-turbine locomotive and may, therefore, be disregarded for comparative purposes. (Actually the transmission efficiency is likely to be sustained at over 83 per cent from full locomotive speed down to 20 per cent of full locomotive speed and under the best circumstances, may in this speed range rise to 86 per cent.)

No locomotive gas turbine within sight is likely to have a peak efficiency as high as 24 per cent, and even this will represent a substantial step forward on the examples at present in service for which the maximum known claimed efficiency is 18 per cent. However, this is a peak efficiency occurring only at the selected useful peak load for locomotive service. At less loads, the efficiency falls substantially and rapidly, so that, for example, the consumption at idling is approximately five times that of the corresponding diesel engine. All factors considered, it is reasonable to assert that the average thermal efficiency of the locomotive gas turbine—corresponding to a peak efficiency of 24 per cent—is not likely to exceed 15 per cent within the foreseeable future.

Therefore, in similar service the fuel consumption of the assumed gas turbine locomotive unit will be in the same relationship as the respective thermal efficiencies (35/15) or 2⅓ times that of the diesel locomotive.

Latest values of fuel consumption for many hundreds of 1,500-hp. diesel locomotives operating on railroads in the United States, is 1.8 U. S. gal. per locomotive unit-mile. Currently the price of diesel fuel as used for locomotives is stable in the United States at approximately 10 cents per U. S. gallon. Fuel cost is, therefore, 18 cents per locomotive unit-mile.

Several variables must be considered in arriving at an estimate of the unit cost of fuel for a gas turbine locomotive. While it seems probable that a grade of Bunker C fuel will be used, this expression covers an extremely wide range of fuels and only the better fractions are likely to be suitable for gas turbines. Improvements in refining processes will tend to reduce the availability of the unwanted and low-price fractions. The unit price varies widely depending on geographical location in relation to oil fields, transport costs, and the demands of local industry. Bearing all the above factors in mind, it is assumed for the purpose of this comparison that Bunker C fuel may be generally available in the grades requisite for gas turbine operation at 5½ cents per U. S. gallon.

For the gas turbine locomotive, therefore, by applying the ratio of efficiency to the fuel consumption of diesel locomotives of 1.8 U. S. gal. per locomotive unit mile, we deduce a fuel consumption of 4.2 U. S. gal. per locomotive mile. At our assumed cost of 5½ cents per gal., this corresponds to a fuel cost of 23 cents per locomotive unit mile.

Cost of Lubricants and Repairs

For our unit of comparison, the 1,500-hp. locomotive, the lubricant cost of many hundreds of existing U. S. diesels is 1.5 cents per unit mile.

There may be some justification for the claim that lower lubricant cost will be an advantage of the gas turbine, due to the fact that it is a rotary engine without cylinder liners, pistons and other moving parts. However, it must be remembered that the lubricant cost includes electric generators, traction motors and running gear, much of which is common to both locomotive types.

Therefore, it would appear generous in favor of the gas turbine, if we assume, for a locomotive unit with this type of prime mover, a lubricant cost of 0.5 cents per unit-mile, thus granting a saving of one cent a mile.

The repair cost per locomotive unit mile for the chosen 1,500-hp. example, taken from records of many hundreds of U. S. diesel locomotives, is 10 cents total, of which 4½ cents relates to the prime mover and the remainder to the electrical transmission equipment and running gear, which will be common to either type. It is a claim in favor of the gas turbine, as yet unproven, that the prime mover repair costs will be lower than for the diesel engine.

In the case of the diesel, it must be recalled that parts are produced in large quantities and at low cost. Maintenance operations proceed on a mileage basis and unexpected failures are usually confined to one cylinder of a multiple cylinder engine, and repairs to which can generally be made with a minimum disturbance to the prime mover as a whole. On the other hand, failure of, say, an individual turbine or compressor blade, may strip a complete stage; the blades are made of expensive material and renewal may involve substantial dismantling of the turbine or compressor and other items of adjacent equipment.

Therefore, it would seem generous to the gas turbine claims if we assume a 40 per cent reduction of the prime mover repair cost which will be only 2 cents per unit mile, a total of 8 cents for the complete unit, compared with 10 cents for the complete diesel.

COMPARISON OF TOTAL OPERATING COSTS PER 1,500-HP. LOCOMOTIVE-UNIT-MILE

	Diesel actual, cents	*Gas-turbine estimated, cents*
Fuel	18.0	23.0
Lubricants	1.5	0.5
Repairs	10.0	8.0
Total	29.5	31.5

Therefore, the increased fuel cost of the gas turbine, at the values taken for this comparison, due to its lower efficiency, can hardly be recovered by reduced lubricant or repair costs despite the use of cheaper fuel. It must, furthermore, be remembered that the above figures for

diesel electric are factual, but in relation to the gas turbine they are optimistic figures which still remain to be proven.

Operating Problems

There are also operating difficulties still to be solved for gas-turbine locomotive applications. Variations in ambient temperature will cause substantial variations in the engine output. A temperature rise of 100 deg. F. may represent a power loss of 40 per cent.

It is necessary to study at least two sets of conditions. In the first, we may consider a railroad having relatively constant daily temperature between summer and winter. In the second condition, we must consider railroads operating generally in hilly country where in a matter of hours the operating conditions may change substantially in temperature and altitude. In either case wide variation in power availability is undesirable. For the diesel locomotive these problems are solved. For the gas turbine locomotive they remain unsolved.

Examples of other operating problems readily occur, such as fire risk due to high temperature exhaust on lines with timber-lined tunnels, structures or over bridges.

New difficulties will arise, in considering public amenity, from the introduction of the new prime mover.

The elimination of noise is a big problem, due to the large volume of air required for gas-turbine operation and the noise level associated with high-speed rotating equipment.

The air intake, filtering and exhaust equally present problems in public amenity for which no easy solution is apparent.

General Conclusion

For general railway service, and in the face of the established and proven economies of the diesel locomotive, there is not yet sufficient factual data to establish that the gas turbine is, or will be, more economic or attractive.

There seems, furthermore, little immediate prospect that the gas turbine will establish such outstanding economic advantages compared with the diesel, to justify the premature claim that the proven economies of the diesel locomotive will be quickly surpassed.

Operational problems, such as variations in output with variations of temperature and altitude, and sustained high efficiency over a wide range of loads may take some years to solve. A gas-turbine locomotive would still retain all the electrical equipment and running gear of the existing diesel locomotive, representing perhaps 80 per cent of the whole in terms of initial cost and annual charges such as interest, depreciation and maintenance.

The main features of the gas turbine, such as light weight and small size, have no particular advantage in the locomotive application. Accordingly, the incentive to develop the gas turbine for locomotives is less than in many other applications, particularly aircraft and stationary uses.

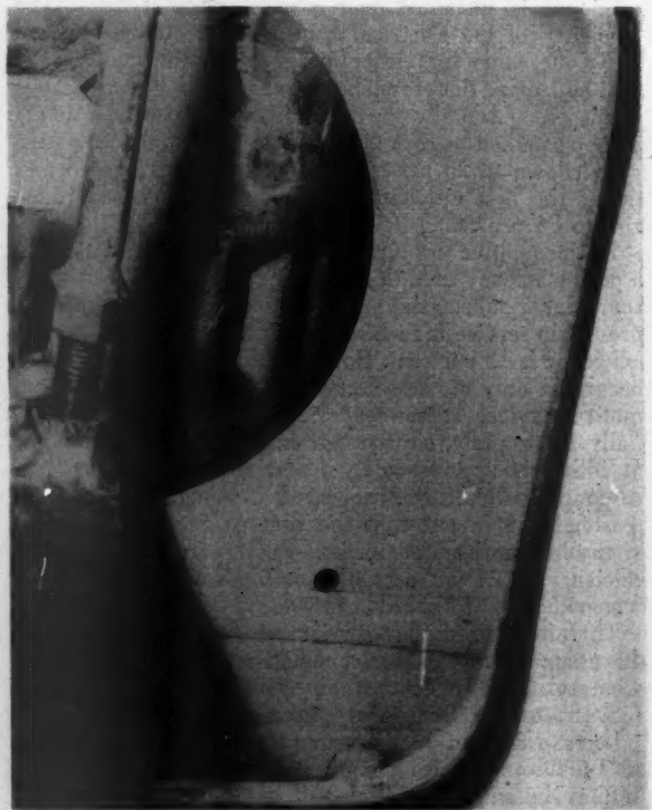
Forward Policy

It appears sensible, therefore, to adopt a forward policy as follows: (1) Let the gas turbine develop first in the application such as aircraft, power stations, and other stationary applications where it has a natural advantage, and then apply, so far as possible, this development work to the locomotive; (2) protect the current investment in diesel-electric locomotives by concentrating developments in the field of gas-turbine locomotives on a power unit which will exactly replace the existing diesel engine prime mover. If and when the gas turbine can be made to show superior advantages and economy, the power unit alone, representing only say 20 per cent of the cost of the locomotive, can then be substituted for the existing engine.

Such assurances should dispel any hesitations which may have been created in either railway or financial circles by premature and unjustified claims for the gas turbine which at this time cannot invalidate proven experience with the diesel-electric locomotives.

Heads Removed Without Disturbing Seals

A liner jack has been developed at the Spencer, N. C., shops of the Southern which removes Diesel engine heads

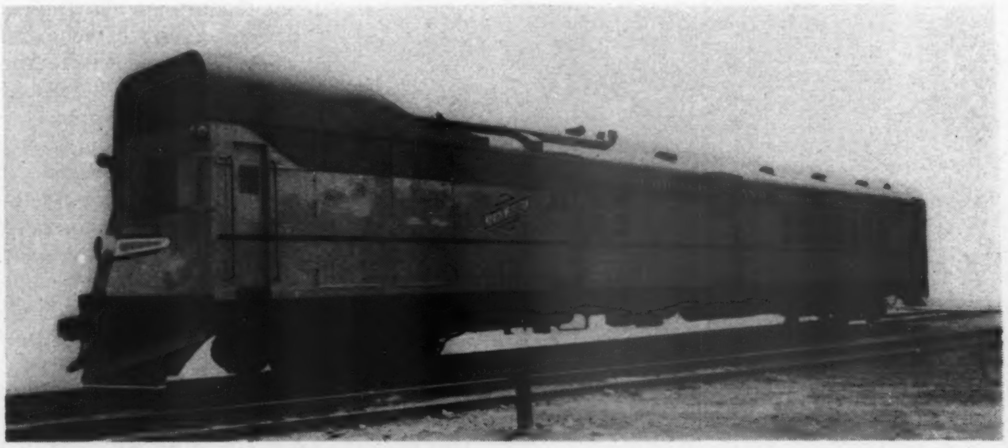


Jack to remove cylinder heads without disturbing liner seals

without disturbing the liner seals. The jack has a spring steel base 3/8 in. by 2 in. and 12 in. long. One end is narrowed to 1½ in. for insertion into the cylinder ports. A nut is welded near this end at a 75-deg. angle with the base, and into it screws a ¾-in. stud 11 in. long with 4 in. of thread.

The base rests against the inside of the ledge where the hand-hold cover normally fits. The base is supported on a 1-in. lug welded on the underneath side about 1½ in. from the cylinder port ends. The top of the shaft fits against the top of the air box. The head is forced off by turning the shaft nut with a wrench.

C. & N. W. Dieselizes Gas-Electric Motor Car



Diesel motor car rebuilt from a gas-electric can pull one trailer and offers complete passenger train service

The passenger compartment seats 28 people comfortably

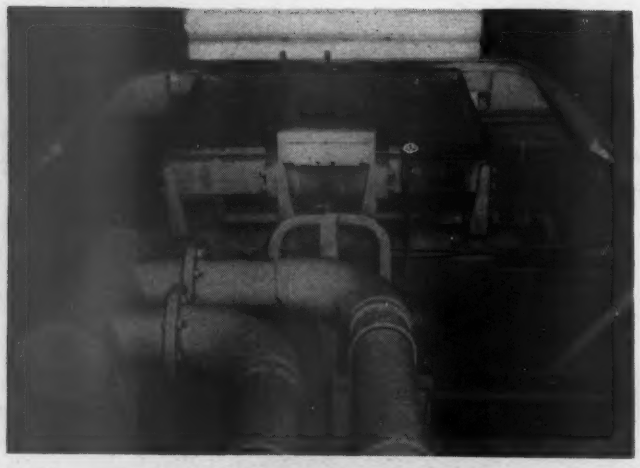
The Chicago & North Western has completed an extremely modern-appearing comfortable Diesel-electric motor car at a cost of $36,000. Designed and built at the road's Kinzie street shops in Chicago the car offers complete passenger train service with seats for 28 passengers, a mail and a baggage compartment. The car is powered by a six-cylinder 4-cycle Sterling Diesel engine with a Buch supercharger which delivers 300 hp. to the traction motors. It is designed for normal operation with one trailer in either secondary line or commuter service. The first assignment will be on a branch line between Madison and Lancaster, Wis.

The car has a length of 83 ft. 6 in. over couplers, a width of 9 ft. 11⅜ in. over the cowling sheets, and a height of 14 ft. 5¼ in. above the rail. It has a top speed of 60 m.p.h. and a weight of 140,000 lb., with approximately 45 tons on the front truck and 25 tons on the rear truck. Four-wheel trucks are used, with the front truck only powered. Fafnir oil-lubricated roller bearings are used on all wheels of both trucks.

The car was converted from an existing gas-electric rail car which was in need of extensive repairs. The existing generator, Type DT-516-A, 450-volt, 200-kw., was repaired by the railroad and sent to the factory for mounting with the Diesel engine. The existing traction motors, Type 292A, were reconditioned and mounted on differnet trucks. New side sills and side plates were applied from the mail room front partition to the back end of the car. From this partition forward there is an entirely new underframe. The old center sills and side sills were cut at this point and all holes plug welded. The same was done with the side sills. The new sections were riveted to the old through splice plates.

A one-piece steel underframe coverplate, 11 ft. 11⅛ in. long, 9 ft. 3 in. wide and ⅜ in. thick. was applied under the entire engine compartment. Expanded metal floorboard for gangways is mounted four inches above the coverplate, giving a space that can be easily hosed out and kept clean. The engine is mounted on 14 Korfund Vibro-Isolators with shear lugs for horizontal shear and switching shocks. Over the engine compartment is a hatch 11 ft. 10⅜ in. long providing a total opening 11 ft. 6⅞ in. long which can be removed in 15 to 20 min.

The nose is fabricated of ⅛-in. steel below the windows and 12-gauge steel above the windows. The car is designed to meet all Railway Post Office requirements. Met-L-Wood partitions are used between the engine compartment and the operator's cab. Insulated metal parti-



Roof arrangement over the engine compartment on the Diesel motor car

tions separate the cab and the mail rooms, the mail and the baggage room, and the baggage room and the passenger space. Adlake breather sash is used for the front windows and standard sash for the remainder. Control is by a hydraulic throttle. New Young radiators were mounted on natural rubber in shear.

The cast steel trucks were taken from another motor car with the center plate and side bearings changed to suit the new installation. The front journals are 5½ in. by 10 in., and the rear journals 5 in. by 9 in. On the interior of the car the wash rooms were enlarged, a luggage storage compartment installed in the rear, the old smoking compartment removed, new upholstered, walk-over-type coach seats were substituted for the old bucket type, a new floor laid, the number of lights doubled, and a 426-amp.hr. battery installed, the latter charged from the exciter through a voltage regulator and a reverse current relay.

Two Hot Water Systems

A water heating system and a hot wash water system are supplied from a 150-gal. storage tank, which is also piped to provide make-up cooling water to the engine in emergency, and to furnish cold wash water and toilet flushing water.

Water for the hot wash water circuit is drawn from the 150-gal. tank to a 20-gal. storage tank through a system of check valves. In passing to the storage tank it receives its heat from the engine cooling water through a heat exchanger located in the cooling water system. The hot wash water is in a closed circuit and is recirculated by a 1/6-hp.-motor-driven pump. The pump operates on the same circuit as the exciter and therefore operates continuously except when the engine is idling. This arrangement makes hot water available at all times. Even when large quantities are drawn the chill is taken off the cold make-up water by passing through the heat exchanger.

A Baker coal-fired hot water boiler located in the baggage compartment and tended by the baggage man supplies the hot water for train heating. This water is circulated by a second pump, with 1/6 hp. motor, located in the baggage compartment. The car heating system is controlled by an aquastat set at 120 deg. on the return water temperature.

Supplies carried on the car include 375 gal. fuel oil, 65 gal. lubricating oil, 190 gal. engine cooling water and 8 cu. ft. of sand.

Altitude Performance of Electro-Motive Model 567 Engine

(Continued from page 61)

box pressure did not decline as rapidly as did the free air pressure with changes in altitude. Exhaust manifold pressure for any given throttle position remained constant at all altitudes and there was little or no visible smoke three feet above the exhaust stack until an altitude of 7,000 ft. was reached. Above this altitude the smoke became progressively darker. At the maximum altitude the smoke was a blue-gray color in all throttle positions.

The fuel oil supplied to the engine during a weighing period was taken from the fuel weigh tank and the return fuel from the engine was cooled and then returned to the weigh tank. The temperature of this fuel remained within 5 deg. during any test period. The pounds of fuel per hour delivered to the engine remained constant for any given throtttle setting, indicating that the injectors did not change and that the power piston setting did not vary throughout the test.

This paper may be summarized by saying that the tests made in the study showed for a particular engine that (1) The power changes in relation to changes in density altitude and (2) that the heat rejection does not vary appreciably with altitude.

The data collected also made possible the construction of a chart showing the horsepower available for tractive force under various altitude and temperature conditions.

Tire Removal And Application Stand

A simple easily constructed frame has been built at the Gulf, Mobile & Ohio shops in Bloomington, Ill. for removing or applying Diesel switcher tires. The stand is made with an indention in the center for holding and securing the wheel set in place for either operation. The width of the stand is such that each wheel overhangs

Stand for applying or removing Diesel switcher tires

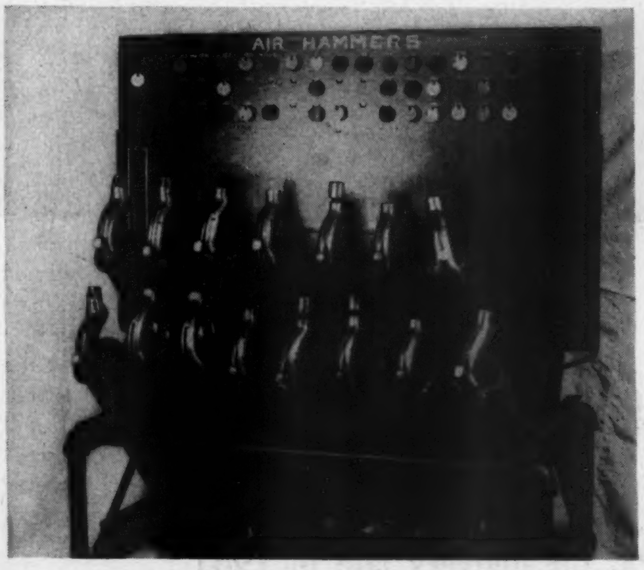
the edge sufficiently to prevent any damage to the stand from heating the tire.

The main members of the frame are of 1-in. pipe, the braces of ¾-in. pipe, and it is of all-welded construction. The width of the stand is 39 in. across the bottom and 36 in. across the top. It is 33 in. deep at the bottom and 20 in. deep at the top.

Air Gun and Drill Racks

The air gun and drill racks, illustrated, used at a western railroad shop, provide a safe and convenient place for holding these shop tools. They conserve space in the tool room and also enable tool check records to be kept with a minimum of extra steps and confusion.

The air gun rack consists of a 2½-in. angle-iron base, supporting two rows of 3½-in. and 4-in. boiler flues, 19 in. long which are welded in the rack at an angle of about 45 deg. and cut out at the top to fit the gun handles.



Special rack for holding pneumatic hammers or air guns

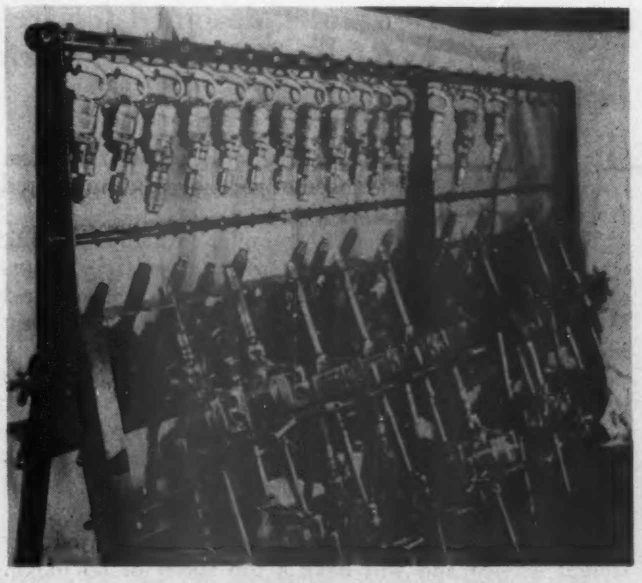
In other words, these notches make a place to receive the handle of the air guns with the throttles in a vertical position for oiling.

A single drip pan under the lower ends of the flue sections catches any oil which runs out of the air guns and thus prevents it from getting on the floor. A board for holding the tool checks is supported in a vertical frame at the center of the rack and saves steps by keeping the tools and checks at the same location.

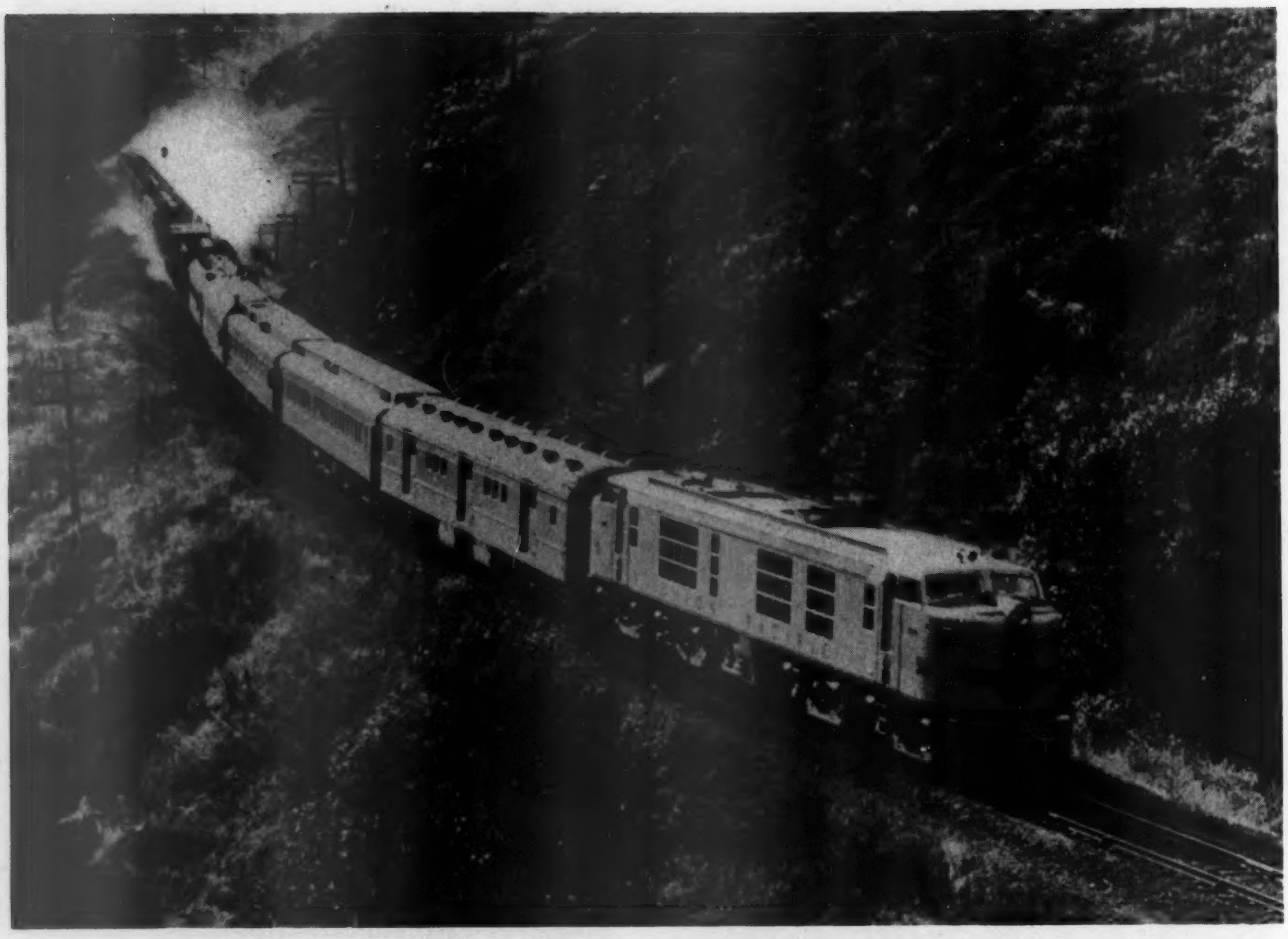
The drill rack, shown in another illustration, is used in the tool room for supporting air drills when not in use, the upper part of the rack holding 23 small drills and the lower part 41 large double-handle drills. There is a small hook above each drill location on which to hang a tool check. The local shop number of each air tool is painted at the proper notch in the frame of the rack and each drill is either at its own place in the rack,

Side view showing construction of the air gun rack

or the user's tool check is there. The rack design permits drills to be easily taken out or replaced and, again, the work of the tool room attendant is made easier by keeping the tools and corresponding checks in the same location.



Tool room rack for both large and small air drills



Union Pacific Orders Ten Gas Turbine-Electric Locomotives

New units, designed for freight service with top speed of 65 m.p.h., will be built at Erie, Pa. for delivery late in 1951

THE UNION Pacific announced on December 28 that ten gas-turbine-electric locomotives have been ordered from General Electric.

The new locomotives will be similar to a 4500-hp. unit which has been undergoing tests on regular freight runs on the Union Pacific for the last year and will be assigned to regular freight service. Delivery is expected to begin in the latter part of 1951. The General Electric Company will build these Alco-GE locomotives at its plant in Erie, Pa.

Acquisition of the units by the Union Pacific is in furtherance of its policy of exploiting fully the possibilities of this modern equipment development for rail transport.

The Union Pacific locomotives will be geared for freight service and will have a top speed of 65 m.p.h. Unlike the developmental unit,* which has an operating cab at each end, the new locomotives will have a cab only at the front end.

In the latest report on performance of the developmental unit on the Union Pacific, G. W. Wilson, manager of the G-E Locomotive and Car Equipment Divisions, said it has operated nearly 80,000 miles in regular freight service and handled 285,800,000 gross ton-miles. The turbine power plant has been in operation nearly 5,000 hours.

The new locomotives will be 83 ft. 7½ in. long over knuckles, 14 ft. 3 in. high over the roof sheets and will negotiate curves of 288-ft. radius. The running gear will consist of four two-axle trucks, with each truck equipped with two traction motors. The weight will be approximately 253 tons.

* A complete description of this unit appeared in *Railway Mechanical Engineer* for July, 1949, page 363.

EDITORIALS

Not Less But More

Motive power department men who complain about diesel-electric locomotives being too complicated express an understandable and widespread attitude. They cite instances in which the failure of protective devices have caused locomotive failures, when there was nothing the matter with the locomotive. The causes of 845 failures which occurred on 545 locomotive units on three roads were listed in a paper by E. H. Holloway, diesel superintendent, Central of Georgia, presented before the Southeastern Railway Diesel Club in August, 1950. Out of the total, 404 were electrical, 224 were caused by the engine, 85 by the air system, 64 by broken pipes, 21 by axles and wheels, 17 by the fuel oil system, 14 by the lubricating oil system, and the remainder by miscellaneous causes. To most mechanical men, nearly all things electrical are inherently complicated, and when they cause 48 per cent of the failures, complaint about complications seems justifiable.

Much is constantly being done by the manufacturers to improve and simplify their locomotives, but at the same time, there are demands for better performance and these include better protection against wheel slip, slide and lock, and improved recovery after slip to insure better locomotive utilization. It seems, rather, that the variety of complications will show little decline and the number of devices is, of course, increasing with the increase in the number of locomotives.

With the additions made during the past year, there are now nearly 14,000 diesel-electric locomotive units in service, representing a total rated horsepower of more than 17,500,000. Capacities have been increased and road locomotive units rated 2,400 hp. have been placed in service. New insulating materials for traction motors have been developed, and although application has not fully proved their efficacy, they will apparently contribute to increased capacities and improved performance.

The one-piece motor coil is finding favor and may eventually dispense with the need for brazing back connections. Traction motor bearings have been improved and high-temperature greases, sealed in between motor overhauls, are establishing an excellent record.

The gas-turbine-electric locomotive continues to increase its threat to the diesel. One has been in regular road service on the Union Pacific during the year as an experimental unit, but the results of the experimentation have evidently been satisfactory since the railroad has ordered ten more locomotives.

Straight electrification was kept in the picture by 100 multiple-unit motor cars being delivered to the New York Central and by two rectifier locomotives now being built for the Pennsylvania. The m.u. cars, which are air conditioned and fluorescent-lighted, employ a traction motor on every axle. The rectifier locomotives should perform exceptionally well, and they will serve to indicate what may one day be expected of an electrification system which uses d.c. traction motors receiving power from a 60-cycle contact system.

Car electrical equipment has become highly complex, but much has been done by the builders to insure trouble-free operation. An important contribution to this is the pressure type terminals and connectors used to make most of the connections on the one to five miles of wire used in each car.

Individual, undercar diesel power plants now in service on an exhibit train are demonstrating the feasibility of using such a power supply system in which each plant feeds the trainline and each car takes from the trainline; the power plants operate in parallel. The Rock Island has demonstrated that it is practicable to operate undercar power plants in parallel with axle generators. The Pennsylvania has successfully operated a twin-unit diner with an all-electric kitchen with the power supplied by two axle-driven generators. The potentialities of heating cars from the waste heat of undercar plants are being explored, and apparatus is being developed for such applications. On-car heating systems, using oil or propane as fuel, are also in process.

The sealed-beam lamps for locomotive headlights will apparently soon cause the single-unit headlight, with its separate reflector, to become little more than a memory.

All of these things add more electrical equipment to railroad service and many mean changes in practice. Some increase complications, but others make for simplified operation. The most evident factor is change. It is human to resist it, but there is nothing so certain as change. Most of the difficulties arise from the rate at which the changes are being made.

Complete Tooling Only Part of the Job

Without doubt, one of the most effective ways of minimizing expenditures for the maintenance of any railroad equipment is proper tooling. When tools, both fixed and portable, are modern, production is increased, and when the tools are provided in sufficient number, nonproductive time is reduced to a minimum by lessening walking and standing around waiting. Because substantial gains can be attained from these two factors, modern tooling and enough of it, tooling may be considered an end in itself and thought of as the final step in attaining the ultimate goal of improved maintenance at reduced cost.

Proper tooling is certainly an important factor in the efficient operation of a shop; probably it is the most important single factor. It forms the foundation for efficient operation. Yet full advantage cannot be taken of even the

best and most complete tooling if job setup and material handling are not accorded their important places in the overall picture. In many cases the time required for the portion of the operation performed by the tool itself, such as machining an awkwardly shaped part or tightening nuts on a subassembly, requires substantially less than half of the time for the complete repair job. The handling and the setup consumes the bulk of the time.

The handling portion of the job can be reduced in several ways. One that is frequently overlooked, or at least underestimated, is bringing the job to the man. It is recognized, of course, that this has been done in numerous instances, particularly in new wheel shops, and that here are many jobs where it is completely impractical to bring the work to the man. However, where the idea is at all feasible, there appears to be good reason for giving the matter thorough study. The amount of time that can be saved for useful productive work through the partial or complete elimination of walking back and forth between jobs may be much greater than is generally realized. And with the continuing tendency toward centralization of facilities, which means shops of greater area the time that can potentially be wasted in walking seems destined to increase.

Shop Equipment Changes Too

The rapid replacement of the steam locomotive by the diesel-electric is an evolution that has had a parallel in the facilities with which motive power is serviced and maintained. Much of the heavy machinery that has characterized the railroad shop of the past has given way, in large part at least, to lighter, more expensive precision machinery designed primarily for inspecting, cleaning, testing and checking the mechanical and electrical parts which must function together in a diesel-electric unit. The buying list of the average railroad operating from a dozen to several hundred Diesel-electric units includes a lot of new names:—manufacturers of equipment such as air filter oilers and washers, lube oil heaters and circulators, chemical parts cleaning equipment, magnetic and electronic testing and inspection equipment, battery charging equipment loading resistors for testing power-plant performance, dynamic balancing machines, vapor degreasers, vacuum impregnators, distillation units, banding lathes and any number of new shop and terminal items.

Prominent in the lists of shop equipment are a variety of new wheel and axle machines, indicative not only of the greatly accelerated demand for wheels and axles but of the previously unheard-of precision of machining that is required of these parts for operation at the high speeds prevalent in both passenger and freight service today.

It is interesting to see that the demand for maximum availability of diesel-electric units for revenue service has caused shop engineers to recognize the absolute necessity of installing every facility that will contribute to the elimination of man-hours and greatly shortened shopping periods. This has brought in material- and parts-handling equipment of all kinds.

The character of shop equipment has definitely changed, but it has not crystallized. In this transition period, the millions that are being spent are indicative of the effort to keep relatively new power going. The nature of the future shop job, when the units are greater in number and require more expensive rebuilding work, may be such as to bring back into the railroad shop many of the heavy production machines formerly used for steam-locomotive repairs and now being used to build the new type of power.

NEW BOOKS

REFRIGERATION ENGINEERING. *Second Edition. By H. J. Macintire, late professor of refrigeration, University of Illinois, and F. W. Hutchinson, professor of mechanical engineering, University of California. Published by John Wiley & Sons, Inc., 440 Fourth Avenue, New York 16. 610 pages, illustrated. 6 in. by 9¼ in. Price, $6.50; in Canada, $8.45.*

Professor Hutchinson has extensively revised Professor Macintire's first edition. Two chapters have been added on transient phenomena in refrigeration and a third on radiation effects. The section on reversed cycle theory has been expanded from two to eight chapters, and the chapters generally have been regrouped to form four sections on Thermodynamics of Reversed Cycles, Load Determination, Refrigeration Equipment, and Special Applications. Over 30 full-page graphical solutions give direct-reading values of the film coefficient of heat transfer for most of the commonly used refrigerants when being heated or cooled as either a subcooled liquid or a superheated vapor. The heat pump is also described from the standpoint of thermodynamic cycle analysis and from the standpoint of transient-heat-flow problems associated with energy sources and energy sinks.

HEAT INSULATION. *By Gordon B. Wilkes, professor of heat engineering, Massachusetts Institute of Technology. Published by John Wiley & Sons, Inc., 440 Fourth avenue, New York 16. 224 pages, 5½ in. by 8½ in. Cloth bound. Price, $4.*

Of particular interest in this compilation on heat insulation for engineers, architects and students is the material and data that has been brought together on reflective insulation, in which field Professor Wilkes has done much of the investigatory work. The essential concepts required for the intelligent comprehension of the subject of heat insulation are presented simply and quite completely in another chapter. Others discuss the various factors that may affect the value of the coefficient of thermal conductivity; various types of test equipment used to determine the effectiveness of heat insulation over a wide range of temperatures; types of insulating materials, moisture in insulation, and economics of insulation. There are also complete tables of conductivity values, specific heat data for heat insulators, emissivity data, etc.

QUESTIONS AND ANSWERS

Diesel-Electric Locomotives

Traction Motors

(continued)

84-Q.—Describe the movement of the handle from one position to another. A.—To pass from one position to another raise the handle, move it in the desired direction until the lower latch hits the far side of the notch. This is a very slight movement. Then depress the handle and move toward the next position.

85-Q.—What happens as the position is reached? A.—The upper latch will drop into the notch, stop the movement and lock the handle.

86-Q.—In connection with the mechanical interlocks, how does the throttle interlock with the selector handle? A.—The throttle can be moved only if the selector handle is in *1, 2, 3* or *4* position.

87-Q.—When can the reverse handle be moved? A.—Only if the selector handle is in either *Off* or No. *1* position and the throttle in *Idle* position.

88-Q.—How does the selector handle interlock? A.—It can be moved to the No. *1* position from *Off* position regardless of reverse handle position. To move selector handle to the No. *2* or No. *3* or No. *4* position the reverse handle must be either in forward or reverse position.

89-Q.—What is necessary on units equipped for dynamic braking? A.—It is necessary that the reverse handle be in the forward position and the throttle in IDLE to be able to move the selector handle into the braking range.

Air Brake Equipment

90-Q.—What air brake equipment is used on all road locomotives? A.—The *24-RL* air brake.

91-Q.—Primarily, what does the cab equipment consist of? A.—The automatic brake valve, independent brake valve and Rotair valve.

92-Q.—What is the rotair valve and where is it located? A.—The rotair valve is a manually operated selector valve having four positions, and is located below the engineer's instrument panel.

93-Q.—What are the four positions? A.—Freight, freight lap, passenger and passenger lap.

94-Q.—When should the handle be placed in freight (Frgt) position? A.—On trains of 51 cars or more when controlled emergency is desired.

95-Q.—How does the controlled emergency affect the action of the locomotive brakes? A.—It causes 40 to 60 seconds delayed action of the locomotive brakes.

96-Q.—When is the handle placed in Frgt. Lap? A.—On trailing *A* units in which position the independent brake valve is cut out in freight service.

97-Q.—When should the handle be placed in Pass position? A.—On trains of 50 cars or less, when the controlled emergency feature is operative.

98-Q.—When is the position* Pass Lap *used? A.—On trailing *A* units in passenger service.

99-Q.—Name several cocks which are important. A.—First service cock, selector cock, brake pipe cut-out cock and safety control cut-out cock.

100-Q.—Describe the function, location and handle positions of the first service cock. A.—As the name implies, it is for cutting in or cutting out the first service operation of the brake valve. It is located on the back side of the automatic brake valve. When the handle is towards the engineer, it is cut in.

101-Q.—Where is the selector cock located and what are its positions? A.—It is located on the rotary valve seat portion and has two positions—*MR*, main reservoir (handle away from the engineer) and *FV*, feed valve (handle towards the engineer).

102-Q.—What is the connection in* MR *position? A.—With the handle on *MR* and the handle of the automatic brake valve in release position, main reservoir air flows to the brake pipe unaffected by the regulating portion of the feed valve and overcharging is possible.

103-Q.—What is the operation in* FV *position? A.—When the handle is moved to *FV* position and the automatic brake valve in release or running position, the brake pipe is connected to the control pipe and feed valve pressure will be maintained in the brake pipe.

104-Q.—Give the function, location and handle position of the brake pipe cut-out cock. A.—It is used for cutting the brake valve in or out. It is located on the lower portion of the automatic brake valve. When the handle is pointing away from the engineer it is cut in and in the vertical position it is cut out.

105-Q.—Give the location, function and handle position of the safety control cut-out cock. A.—The safety control cut-out cock on the service application portion is used to cut in or out all safety devices (dead man control, locomotive overspeed and train control, if used). With the handle down, all safety devices are cut in.

106-Q.—Describe the location and function of the control valve. A.—It is located in the nose of the *A* units and in the forward end of the *B* units, and when actuated by the brake valve, operates to charge, apply and release the brakes.

107-Q.—What does the control valve in the* B *units include? A.—The controlled emergency cock which should be positioned at *F* or *P* to correspond with the position of the rotair valve in the leading *A* unit.

108-Q.—What features are common to control valves in the* A *and* B *units? A.—Charging change-over cock, dead engine cock and graduated release cap.

109-Q.—How should the charging change-over cock be positioned? A.—At *F* or *P* to correspond with the position of the rotair valve in the leading *A* unit. When in *F*, charging of the auxiliary reservoir is at a slow rate, while in *P* the rate is much faster.

110-Q.—Describe the positions of the dead engine cock. A.—Should be in *Live* position for normal operation and in *Dead* position when the locomotive is hauled dead in the train.

111-Q.—Describe the positions of the graduated release cap. A.—Two positions, *Gra* and *Dir* for graduated release and direct release. Graduated in passenger and light freight service, and direct in heavy freight.

112-Q.—Where is the dead man pedal located, and when must it be depressed? A.—It is located on the floor in front of the engineer's seat, and must be depressed at all times, except when the locomotive is stopped, and when 30 or more pounds of brake cylinder pressure exists.

113-Q.—What takes place if the pedal is released during operation? A.—The safety control whistle will sound for two to four seconds, during which time the pedal can be depressed, preventing brake action. Otherwise, full service application of brakes will be made.

Schedule 24RL Air Brakes

SAFETY CONTROL FEATURE (*continued*)

Operation of the Service Application Portion

1007-Q.—What connection is made when the rotair valve is in freight position? A.—Passage *23*, which connects to the first suppression reservoir through pipe *23* and passages *23* and *33*, and suppression timing reservoir (if used) in FREIGHT position of the rotair valve, is connected by cavity *S* to passage *31* leading to the timing valve choke *X* and to the diaphragm chamber of the timing valve *121*.

1008-Q.—What does this provide for? A.—It permits a timed exhaust of the first suppression air from the top of the timing valve diaphragm *124* to provide for a split reduction of brake pipe pressure.

1009-Q.—Describe this operation further. A.—Air from the first suppression reservoir deflects diaphragm *124* in the brake valve which seats valve *121* and prevents the flow of first reduction reservoir air from passages *5* and *18* past valve *121* into passage *18* to atmosphere.

1010-Q.—What limits the initial brake pipe reduction? A.—Equalizing reservoir air reduces from passage *5* into *24* and the reduction limiting reservoir and limits the initial brake pipe reduction.

1011-Q.—When is the timing valve opened? A.—Timing valve *121* is opened when the air pressure in the first suppression reservoir and in the chamber on top of diaphragm *124* has reduced to about *10* lb. through timing choke *X*.

1012-Q.—What then serves to provide a full service application? A.—Combined volumes of the equalizing and reduction reservoirs then flows past the timing valve *121* into passage *18* to provide a full service application.

1013-Q.—Can the safety control application be released in Release, Running and First Service positions? A.—No.

1014-Q.—What prevents release in these positions? A.—Cavity *t* in slide valve *114* connects passage *10* from the top of piston *112* to passage *8*, leading to the exhaust valve *235*, which is open to atmosphere in these positions.

1015-Q.—What connection is made in the event that the electro-pneumatic brake valve portion is not used? A.—In this case, passage *8* leads to rotary valve *216* and the atmosphere.

1016-Q.—What position of the brake valve must be used to release a safety control application? A.—Lap position.

1017-Q.—Why does the application release in Lap position? A.—Pressure builds up in chamber *B* on top of piston *112* to build up as previously described under Charging.

Operation of Emergency Application Portion

1018-Q.—How is the safety control system charged when the emergency application portion is used? A.—It is charged with brake pipe air from chamber *B* through a choke in the emergency application piston *161* to chamber *C*, passage *10*, pipe *10*, to chamber *C* in the cut-off valve of the H-24 Relayair valve unit.

1019-Q.—What is the position of cut-off valve diaphragm, with the brakes released? A.—With brakes released and no air in chamber *D* over diaphragm *10*, the diaphragm is moved to its upward position by spring *6*.

1020-Q.—What action follows this movement? A.—Valve *17* is unseated and permits spring *19* to move lower valve *15* to its upper seated position.

1021-Q.—When this happens, how does the air flow? A.—Air from chamber *C* can then flow to chamber *A* and out passage *3* to pipe *3* and the diaphragm foot valve.

1022-Q.—Is the safety control system then charged? A.—Yes, if the rigid handle brake valve is used.

1023-Q.—What is the result if the hinged handle type is used? A.—If the diaphragm foot valve is released, diaphragm *6* will be off its seat and air can flow to pipe *3* and passage *3* in the brake valve to the chamber on top of exhaust valve *351*, which is seated when handle *370* is depressed.

1024-Q.—When does piston* 161 *assume release position? A.—When the safety control system and chamber *C* in the emergency application portion are charged to brake pipe pressure.

1025-Q.—How is a safety control application initiated? A.—If the foot pedal is released with the rigid handle brake valve, or both the foot pedal and brake valve handle are released with the hinged handle type.

1026-Q.—Describe action taking place with the rigid handle type. A.—Air from chamber *C* on the spring side of emergency application piston *161* is vented through passage *10*, pipe *10*, chamber *C* in the cut-off valve, chamber *A*, passage *3* and pipe *3* to the diaphragm foot valve and choked exhaust and whistle.

1027-Q.—Describe the additional flow of air if the hinged handle type is used. A.—Past diaphragm *6*, pipe *3* to the brake valve, passage *3* and past open exhaust valve *351* to the atmosphere.

1028-Q.—What insures the movement of piston* 161 *to application position? A.—The choke in piston *161* prevents build up of air from chamber *B* to chamber *C* as long as the foot pedal *12* and brake valve handle *370* are not held down or the brake applied sufficiently (with control pipe pressure about 30 lb.).

1029-Q.—What results from piston* 161 *being in application position? A.—The brake pipe supply in chamber *B* is cut off from the brake pipe chamber *A*, and chamber *A* is connected to the atmosphere to cause an emergency rate of brake pipe reduction.

1030-Q.—How does valve* 173 *function at this time? A.—It is moved off its seat which action vents chamber *C* through passage *8* to atmosphere when the brake valve handle is in release, running or first service positions.

NEW DEVICES

Hydraulic Feed Car-Wheel Borer

Just announced is the Niles Hydraulic Feed Car Wheel Borer which is designed to rough and finish machine and chamfer the bore, face hubs of cast iron or steel car wheels, bore, face, and shoulder both sides of the hub of diesel locomotive wheels, and to machine the plate or web of wheel and outer diameter of hub for balancing purposes with a minimum of machining time and effort on the part of the operator.

The vertical round boring ram operates on a semi-automatic feed and traverse cycle control, permitting also manual control. Fine and course feeds and power traverse in both directions are available. An infinite fine feed selection within the range, with the control located in front of the operator, makes it possible to readily select the most efficient feed for a particular speed or material.

The machine, introduced by The Niles Tool Works Co., Division Baldwin-Lima-Hamilton Corp., Hamilton, Ohio, has a self-centering five jaw automatic chuck table which can be furnished with two types of chuck jaws. One type of chuck jaws permits chucking or 44 in. diameter car wheels or diesel wheels. The jaws are arranged to permit facing and shouldering diesel wheels on both sides. Another type of chuck jaws permits chucking of 48 in. diameter wheels for boring, chamfering, and facing the inside of the hub.

A drive box inserted in the rear of machine frame, completely enclosed, but ventilated, provides six speeds to the table arranged in geometrical progression. A low table speed range and a high table speed range are provided for the use of high speed steel and carbide tools and are obtained by use of either a two-speed a.c. or a two-speed d.c. drive motor having a 4 to 1 speed ratio. The drive box is driven through texrope belts. Gear change levers can be manipulated without any exertion on the part of the operator.

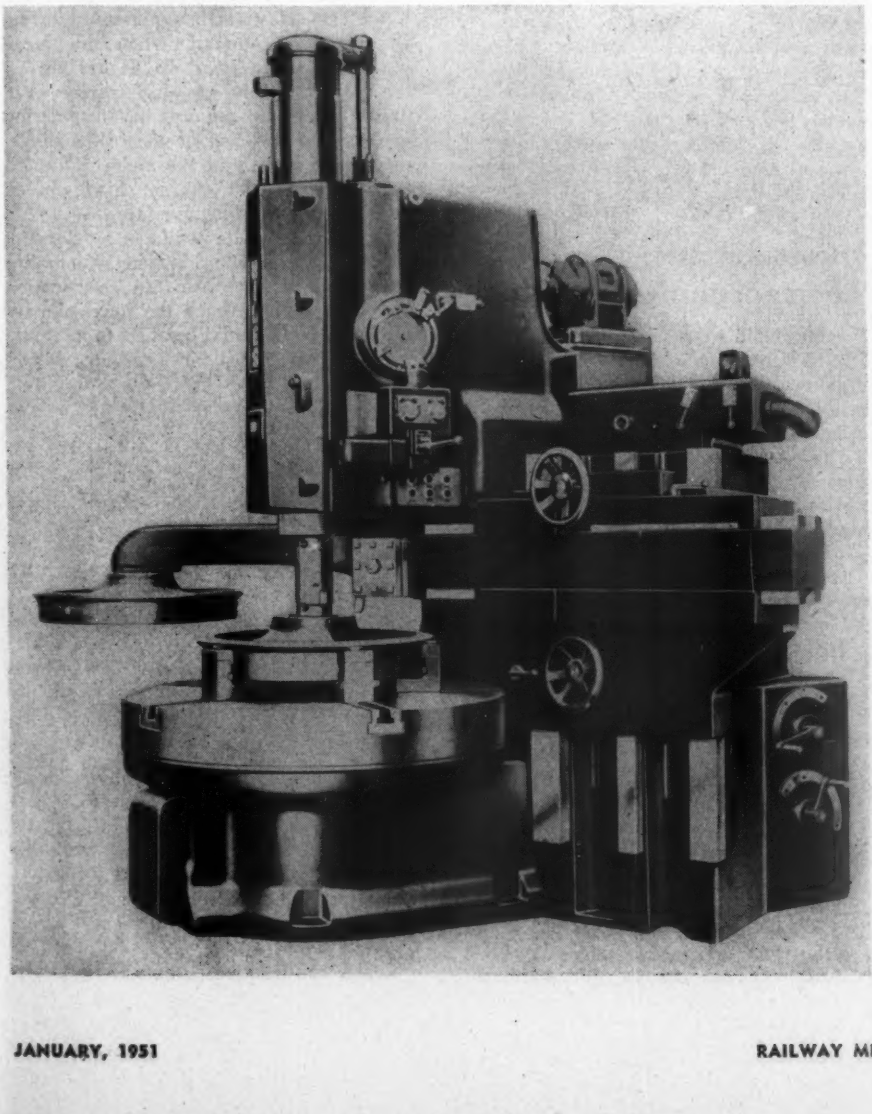
The five jaw chuck table is properly sectioned, ribbed and reinforced to resist breakage or deformation. Five radial tee slots on top are provided to receive the serrated steel chuck slides. The universal steel chuck jaws are adjustably mounted on top of these slides.

A large compression type table brake operated by a hydraulic cylinder and controlled by a solenoid valve is provided. Its function is to brake the coasting of the table after the main drive motor is deenergized, thus decreasing the floor to floor time for each wheel.

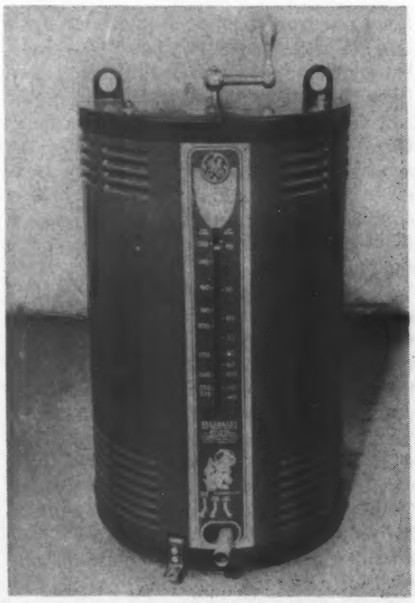
The drive box is a separate unit. Completely assembled, it is inserted into the rear of the column base, and properly supported and bolted to it.

The machine is supplied with a pump unit for vertical boring ram. It is incased in the top of the column, and is driven by a 3 hp. constant speed motor directly coupled to the pump.

The table drive is by a 20/40 hp. two-speed a.c. or a two-speed d.c. motor mounted on slide rails on the floor at the rear of the machine. The low speed table range is 7 to 30 r.p.m. and the high speed table range 30 to 125 r.p.m.



Silicone-Insulated A.C. Welder



A silicone-insulated, portable a.c. welder, equipped with automatic, hot-start control has been announced by the Welding Divisions of General Electric's Apparatus Department. Known as 6WK30J series, it is one of the first standard a.c. welder lines commercially available, incorporating silicone insulation. A high margin of safety and operating dependability is provided by this insulation since it is unaffected by high temperatures and is water repellent.

For striking the arc, the correct amount of boost is always furnished for any specific current setting. The ampere range is covered by three overlapping current ranges which permit precise current control. Thus, with hot-start control and overlapping current ranges, current is reduced to a minimum and more efficient use of electric power is accomplished.

The automatic arc starting control con-

sists of a hermetically-sealed gas-filled time-delay magnetic switch and a wound resistor which causes a surge of increased current to flow through the welding leads. This surge is present only during the critical starting period, and its degree is considerably higher at very low hard-to-start currents than at higher, easier to start current settings. Automatic reduction of boost at higher current settings avoids drawing current surges from the power line.

Coils of the welder are impregnated with Class H insulation, characterized by the use of asbestos, glass, and mica, impregnated by synthetic high temperature resisting resins known as silicones. The welder is not limited to short-time operation to avoid overheating.

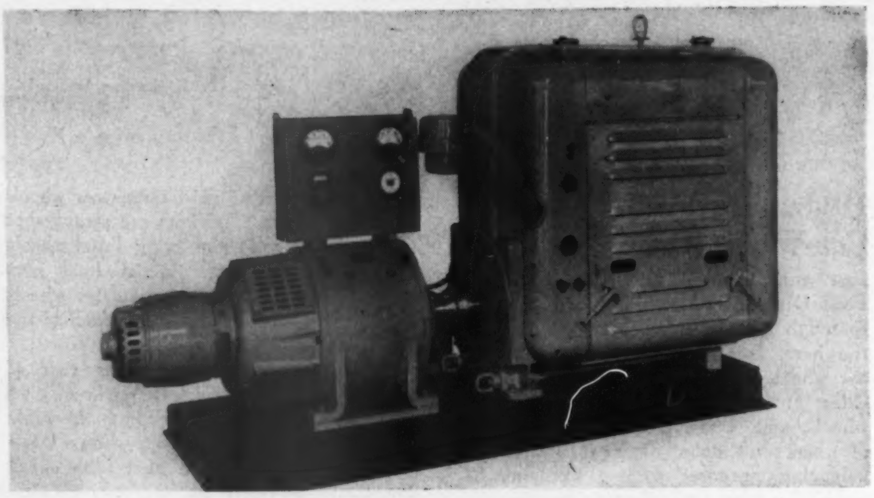
The unit is 17 in. in diameter, and 35 in. in height, permitting utilization of underbench space not available to larger welding units. It weighs 325 lb., and has a current range from 40 to 375 amp., and accommodates electrodes from 3/32 to 1/4 in. diameter. Mounted on a running gear, it can be easily moved when required.

Plugs Protect Standby Power Cables

Field proven and promptly available, Joy's new railway snap-out plugs for standby battery charging and air-conditioning power lines, have been made available by the Joy Manufacturing Company, Henry W. Oliver building, Pittsburgh 22, Pa. Designed to disconnect when pull on the cable reaches 50 lb., the plugs protect equipment and personnel from injury when the train moves before proper disconnects can be made.

In action, the male snap-out in a 30-in. car jumper section pulls out of the female snap-out on end of trailing cables. When this occurs, the car relay circuit is broken through a pilot circuit (small pins) and the car's power is cut off its standby receptacle. The short jumper section remains with train for damage-free removal later and the undamaged trailing cable with its female end connector (contacts recessed in Neoprene) remains at its station. The assembly is shatter-proof, water-tight and wear-resistant.

One of the illustrations shows the female snap-out which is attached to the charging cable and the other shows the short section which stays with the car in case the car is moved before the cable is disconnected.



Stand-By Power Source

A 12½ kw., single-phase, remote-start type DAC125R motor-generator set is being produced by the Electric Specialty Co., Stamford, Conn. It is one of a line of remote, manual, or automatic start Diesel and gasoline electric power sources designed for railroad stand-by power.

The units are featured by their compact size, rugged construction, and close voltage regulation. Gasoline-powered units are available in ranges from 300 watts to 20 kw., and Diesel-powered units from 1½ to 20 kw. Generators supply d.c. and a.c. single-, two-, or 3-phase power.

Sealed-for-life bearings and drip-proof construction minimize service requirements. The engine is replaceable as a unit, and the generator armature may be removed and replaced without dismounting either the generator frame or the engine. All rotating parts are dynamically balanced before assembly and each set is test run with its own power under actual load conditions.

Diesel Engine Thermocouples

Now available are a series of Brown Diesel engine thermocouples equipped with stainless steel or carbon steel protecting tubes which are specifically designed for measuring cylinder exhaust temperatures.

These units, which are said to be extremely accurate, develop a large electromotive-force and are built to withstand severe vibration and corrosion. Although designed primarily for use on Diesel engines, the type of construction has been found ideal for many other applications.

The terminal block is molded from heat-resistant insulating material with raised characters for permanent identification of type and polarity of thermocouple. Washer head screws are provided for convenient and secure leadwire connections. This device is available from the Industrial Division, Minneapolis-Honeywell Regulator Company, Philadelphia 44, Pa.

Journal Box Lid

The illustrated journal box lid can be attached or removed quickly without the use of tools. Incorporated into the design of the lid is a keeper-pin that holds the hinge assembly under pressure during shipment and storage. When the hinge pin has been inserted, hand pressure on the lid permits the keeper-pin to be withdrawn easily. It requires no hammering or fastening to insert or secure the hinge-pin. Stops formed in the ends of the lid bearing holds the straight hinge-pin in position under spring pressure.

This device, made available by the Motor Wheel Corporation, Lansing, Mich., has been certified by A.A.R. to specification M-120-47. Both ends of the hinge-pin are supported by ¾ in. lid bearings to minimize wearing of lid holes and scoring of hinge-

pin. The unit, which is made of pressed steel, opens to 120 deg. for easy access to the journal.

Center construction permits full articula-

tion up, down, right or left, insuring a tight fit on all journal boxes. A series of press fits and shear riveting makes the articulation point oil tight. An extended housing arm eliminates all opening and closing strain from the articulated point.

The lid is made in standard models and in deep flange models which provide protection from wind currents carrying foreign matter and moisture.

Thread and Gasket Sealing Compound

Rectorseal, a product developed by the Rector Well Equipment Company, Houston 2, Tex., can be used on casing and tubing joint connections in high pressures up to 8,350 p.s.i.

The compound, designated No. 2, forms a plastic elastic mass which seals the connection and keeps it leak proof. It will not cut-out under pressures or temperatures and will not harden and freeze the connection. It is impervious to LP-gas, natural or manufactured gas, gasoline and many other commodities.

In addition to being insoluble in the materials for which it is recommended, the product is non-corrosive, adheres well to metals, lubricates as well as seals. As a gasket paste, it is self-leveling so that it does not dry in waves or ridges to prevent proper mating of flanges.

There is a compound to meet practically every thread and gasket sealing requirement. For services where this compound is not listed or recommended, special formulas are available to meet sealing requirements.

Air Operated Nut Running Tool

Two devices, known as Impactools, the size 504 for nut running up to ⅝-in. bolt size, and the size 510 for nut running up to ¾-in. bolt size are now being offered by the Ingersoll-Rand Company, New York 4.

As illustrated, both tools are of the

pistol grip type, and are balanced for ease of operation. The large, easy to grip reverse caps are grooved so the tools may be quickly reversed even with greasy hands.

In designing these tools, emphasis has been placed on muffling to lower operator fatigue and increase safety. To save time on assembly operations, both units have a high run-down speed before impacting starts. Small vane type air motors give all the speed and power needed to handle difficult nut running jobs.

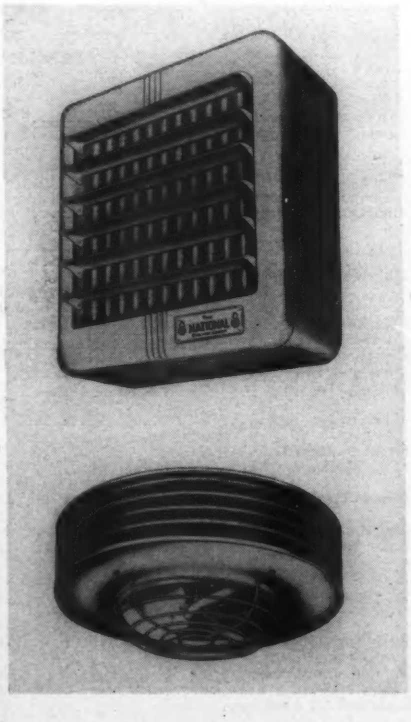
The size 510 unit is completely new. Designed for jobs where it is convenient to have one hand free to hold the work, the manufacturer states that it is the most powerful Impactool for one hand operation. It weighs 11¼ lb. and measures 10⅞ in.

The size 504 is a completely redesigned tool, reputed to be 20 per cent more powerful and 65 per cent faster than the old model. This unit may also be used for multipurpose operation in drilling up to ⅜-in. diameter or step drilling to ¾ in., reaming up to 9/16-in. diameter, tapping up to ⅝-in. diameter, driving screws up to ⅜-in. machine, etc. It weighs 5¾ lb. and is 8-9/16 in. long.

Built-in lubricating systems in both sizes assure continuous performance and trouble free operation. Built-in air strainers keep rust, scale, dirt, small bits of hose, etc. out of the motors which prevents scoring or undue wear.

Unit Heaters

National Unit Heaters which can be used on either steam or hot water heating systems to secure a horizontal or down flow vertical delivery of warmed air, are now



being marketed by the National Radiator Co., Johnstown, Pa. There are 24 different sizes of horizontal units and 16 different sized vertical units.

At 2 lb. steam and 60 deg. F. entering air temperature, the new models are rated from 25,900 to 360,000 B.t.u. per hr. for horizontal sizes. The vertical units are available from 32,600 to 500,000 B.t.u. per hr. There are also 14 units specially designed to deliver air at low temperatures when used with high temperature steam.

Standard and heavy duty cores are available, both fabricated from seamless copper tubing. Rippled aluminum fins are bonded by a hydraulic expansion of the copper tubes. Fans are of the propeller type and motors are made specially for fan duty.

In both horizontal and down-flow units, the fan shroud is an integral part of the steel cabinet which is said to be scientifically designed to assure maximum fan performance and quiet operation. Cabinets have a baked-on crinkle finish to insure permanence and to resist corrosion.

Heavy Duty Locomotive Shutter

Shutters that are designed for severe service on all types of diesel locomotives have been developed by the Minneapolis-Honeywell Regulator Company, Industrial Division, Philadelphia 44, Pa.

The shutters, a part of Honeywell's engine temperature control system, can be installed on existing as well as all new locomotives and switchers.

Although developed for heavy duty operation, the shutters actually are lighter in weight than most shutters now being used. They can be installed on stationary power plants as well as on locomotives. The frame of the device is constructed to shed water away from the bearings so that freezing up because of excessive ice formation is avoided.

The design also creates a tight closure without the use of rubber or felt. Air leakage is eliminated at the full closed position by means of overlapping.

Diesel Engine Indicating Pyrometer

A combined indicating millivoltmeter pyrometer and rotary switch designed specifically for checking Diesel engine exhaust temperatures has been introduced by the Industrial Division, Minneapolis-Honeywell Regulator Company, Philadelphia 44, Pa.

Available in several sizes and types, these units can be furnished for surface mounting, interchangeable for bottom or back connection with conduit. In place of automatic compensation for thermocouples, the moving system is provided with a special neutralizer having a negative temperature coefficient.

Its galvanometer is pivoted on jeweled bearings. Swing of the unit is automatically retarded when the switch is in the off position, thus preventing needless wear from vibration.

Large contact type rotary switches with 6, 12 or 24 points, as specified, and with dial numbered 1 to 6 and off, 1 to 12 and off or 1 to 24 and off respectively are offered.

In place of internal connections, the instrument is complete with 20 in. of leadwire extending from it to each switch point. Instruments with 0 to 1,000 deg. F. range may be furnished with a scale zoned in colors, with black (cold) zone 0 to 250 deg. F.; white (normal) zone 250 to 500 deg. F.; and red (danger) zone 500 to 1,000 deg. F.

NEWS

A.S.M.E. Installs New Officers

At the annual meeting of the American Society of Mechanical Engineers Railroad Division, held in New York, November 28 and 29, the following members of the Railroad Division Executive Committee were installed for 1951: Chairman, C. E. Pond, assistant to superintendent motive power, Norfolk & Western, Roanoke, Va.; K. A. Browne, research consultant, Chesapeake & Ohio, Cleveland, Ohio; C. B. Bryant, chief engineer, Technical Board, Wrought Steel Wheel Industry, Chicago; G. W. Bohannon, chief mechanical officer, Chicago & Northwestern, Chicago; E. M. Van Winkle, vice-president, American Steel Foundries, New York.

New officers appointed to the General Committee included J. S. Newton, manager, engineering department, Baldwin Locomotive Works, Eddystone, Pa.; M. C. Haber, general mechanical engineer, Union Pacific, Omaha, Neb.; C. D. Stewart, vice-president, Westinghouse Air Brake Company, Wilmerding, Pa.; B. C. Gunnell, chief mechanical engineer, Southern, Washington, D. C.; A. G. Hoppe, engineer, Research and Development, Chicago, Milwaukee, St. Paul & Pacific, Milwaukee, Wis.; Alexander Ross, mechanical engineer, American Locomotive Company, Schenectady, N. Y.

J. Calvin Brown, engineer and patent attorney of Los Angeles, Calif., is the newly elected president of the Society. Regional vice-presidents for 1951 are Henry R. Kessler, manager, Republic Flow Meters Co., New York; Stephen D. Moxley, vice-president, American Cast Iron Pipe Co., Birmingham, Ala.; Dr. John T. Rettaliata, dean of engineering, Illinois Institute of Technology, Chicago; Carl J. Eckhardt (re-elected), professor of mechanical engineering and superintendent of utilities, University of Texas, Austin, Tex. Directors-at-large are Lionel J. Cucullu, assistant to chief engineer, New Orleans Public Service, Inc., New Orleans, La.; and Harold E. Martin, district manager, Babcock & Wilcox Co., New York.

4,500-Hp. Gas-Turbine Operation Report

The 4,500-hp. developmental gas-turbine electric locomotive, while built as a double-ended unit, has been operated single-ended since September 29, 1949, according to a report released on November 24 by A. H. Morey, Locomotive and Car Equipment Division, General Electric Company. Four swivel trucks make up the B-B+B-B running gear. The locomotive is geared for 69 m.p.h. and has an average weight of 506,000 lb.

The power plant is of single-shaft design and operates on the simplest gas-turbine

(Continued on page 84)

ORDERS AND INQUIRIES FOR NEW EQUIPMENT PLACED SINCE THE CLOSING OF THE DECEMBER ISSUE

DIESEL-ELECTRIC LOCOMOTIVE ORDERS

Road	*No. of units*	*Horse-power*	*Service*	*Builder*
Canadian National	14 A[1]	1,500	Road freight	Gen. Motors Diesel
	14 B[1]	1,500	Road freight	Gen. Motors Diesel
	6 A[1]	1,600	Road freight	Montreal Loco. Wks.
	6 B[1]	1,600	Road freight	Montreal Loco. Wks.
Louisville & Nashville	13[2]	1,500	Road	Electro-Motive
	10[2]	1,500	Freight	Electro-Motive
	25[2]	1,200	Switching	Electro-Motive
	14[2]	1,500	General purpose	Electro-Motive
Missouri-Kansas-Texas	5	2,250	Passenger	Electro-Motive
	4	1,600	Road switch	Fairbanks, Morse
	2	1,600	Road switch	Alco-G. E.
Missouri Pacific Lines	19[3]	1,500	Freight	Alco-G. E.
	6	2,000	Passenger	Alco-G. E.
	10	1,500	Freight	Electro-Motive
	32	1,500	Road switch	Electro-Motive
	17	1,200	Switching	Electro-Motive
	20	1,200	Switching	Baldwin
Gulf Coast Lines	7	1,500	Road switch	Electro-Motive
	5	1,200	Switching	Electro-Motive
International Great Northern	6	1,500	Road switch	Electro-Motive
	2	1,500	Road switch	Baldwin
Pacific Great Eastern	6[4]	1,600		Montreal Loco. Wks.

DIESEL-ELECTRIC LOCOMOTIVE INQUIRIES

Central of New Jersey	14	1,600	Transfer
	1	1,000	Road switch
	16	1,200	Yard switch

FREIGHT-CAR ORDERS

Road	*No. of cars*	*Type of car*	*Builder*
Atlantic Coast Line	18	Dump	Magor Car
Bessemer & Lake Erie	500[5]	90-ton hopper	Pullman-Standard
Central of Georgia	300	50-ton box	Pullman-Standard
	200	50-ton gondola	Pullman-Standard
	25	70-ton covered hopper	American Car & Fdry.
Chicago & North Western	7[6]	70-ton covered hopper	Pullman-Standard
Chicago, Indianapolis & Louisville	50	50-ton flat	Greenville Steel Car
Chicago, Milwaukee, St. Paul & Pacific	250[7]	Covered hopper	Company shops
	50[7]	Caboose	Company shops
	30[7]	Gondola	Company shops
	42[7]	50-ton box	Pullman-Standard
Chicago, Rock Island & Pacific	500[8]	70-ton gondola	American Car & Fdry.
	2,000[8]	50-ton box	Pullman-Standard
	1,000[8]	50-ton box	American Car & Fdry.
Clinchfield	40	70-ton covered hopper	American Car & Fdry.
Columbia, Newbury & Larurens	50[9]	50-ton box	American Car & Fdry
Cuyahoga Valley	100[10]	70-ton gondola	Magor Car
Denver & Rio Grande Western	10[11]	Caboose	Company shops
Detroit, Toledo & Ironton	300[12]	50-ton auto. box	General American
	200[12]	70-ton gondola	American Car & Fdry.
Georgia	100[13]	50-ton gondola	American Car & Fdry
	50[13]	70-ton hopper	Greenville Steel Car
Great Northern	100[14]	70-ton covered hopper	American Car & Fdry
Gulf, Mobile & Ohio	700[15]	50-ton box	American Car & Fdry
	300[15]	50-ton gondola	Pullman-Standard
Illinois Central	1,000	50-ton gondola	Company shops
	9	Dump	Magor Car
Kansas City Southern	100[16]	50-ton auto	General American
Lake Terminal	150	70-ton gondola	Magor Car
	150	70-ton hopper	Magor Car
Mather Stock Car Co.	100[17]	40-ton refrig	Company shops
Newburgh & South Shore	100	70-ton gondola	Magor Car
New York, Chicago & St. Louis	50[18]	70-ton covered hopper	Greenville Steel Car
	150	70-ton flat	Greenville Steel Car
New York, New Haven & Hartford	200	50-ton flat	Company shops
Norfolk Southern	5	70-ton covered hopper	American Car & Fdry.
St. Louis Southwestern	100[19]	50-ton box	Pullman-Standard
Union	500[20]	70-ton gondola	Greenville Steel Car
Seaboard Air Line	500	50-ton box	Pullman-Standard
	300	70-ton hopper	Bethlehem Steel
	300	50-ton gondola	Bethlehem Steel
	25	Caboose	Company shops
Union Tank Car Co.	1,000[21]	50-ton tank	American Car & Fdry.
Wabash	50[22]	70-ton gondola	American Car & Fdry.
Youngstown & Northern	150[23]	70-ton gondola	Greenville Steel Car

FREIGHT-CAR INQUIRIES

Grand Trunk Western	500	50-ton box

[1] For delivery early in 1951.
[2] Deliveries scheduled to begin early next May and to extend through mid-July.
[3] The authorization to purchase this equipment for the Missouri Pacific and its subsidiaries, the Gulf Coast Lines and the International Great Northern, was announced in the December issue, page 762.
[4] Delivery schedule for January and February, 1951. To cost $1,200,000.
[5] Delivery scheduled for the fourth quarter of 1951. Estimated cost, $4,250,000.
[6] Delivery scheduled for the second quarter of 1951.
[7] Caboose cars to be completed in June; the covered hoppers in October; the gondolas in November. Delivery of the box cars, which will cost approximately $222,000, is scheduled for the third quarter of 1951.
[8] For delivery during the fourth quarter of 1951.
[9] To cost approximately $300,000. Delivery scheduled for the third quarter of 1951.

[10] To cost approximately $600,000. Delivery scheduled for July.
[11] For delivery during the first quarter of 1951.
[12] The box cars, to cost approximately $2,185,000, are scheduled for delivery during the third quarter of 1951; the gondolas, to cost about $1,146,000, scheduled for delivery during the fourth quarter.
[13] Delivery of the gondolas expected in June; the hopper cars, in October.
[14] Delivery of the gondolas, to cost approximately $479,658, is expected in June; of the hopper cars, to cost approximately $276,469, in October.
[15] Estimated cost, $660,000. Delivery scheduled for third quarter of 1951.
[16] Approximate cost, $900,000. Deliveries scheduled for June and July.
[17] Construction to begin during the first half of 1951.
[18] Deliveries scheduled for July and August.
[19] Deliveries scheduled for between June and September.
[20] To cost approximately $2,840,000. Deliveries scheduled for August and September.
[21] Delivery tentatively scheduled for the second quarter of 1951.
[22] For August delivery.
[23] To cost $900,000. Delivery scheduled for fourth quarter of 1951.

NOTES:

Atlantic Coast Line.—The A.C.L. has purchased five twin-unit dining cars from the Chesapeake & Ohio at an approximate cost of $1,150,000. Three were built by Budd and two by Pullman-Standard.

Grand Trunk Western.—The G.T.W. is planning a heavy program of equipment purchases and needed maintenance projects if anticipated 1950 net income of $3,882,393 is realized, according to Donald Gordon, chairman and president of this Canadian National subsidiary. A study, he said, has shown the advisability of acquiring 62 diesel-electric road and switching locomotives and up to 1,400 freight cars of various types. An inquiry for 500 50-ton box cars has already been sent out, as noted above. The feasibility of obtaining new passenger equipment also is under consideration, as is increased mechanization.

Missouri Pacific.—Authority to spend almost $7,000,000 during 1951 for improvements to property was granted the Missouri Pacific Lines by the United States District Court at St. Louis on November 21. Of this $4,785,000 will be allocated to the Missouri Pacific proper, $1,254,600 to the Gulf Coast Lines, and $849,710 to the International-Great Northern. Among the improvements contemplated is the elimination of a tunnel at Vineland, Mo., preparatory to operation of planetarium dome cars on the "Texas Eagle." Over $300,000 will be alloted for installation of new and improved air-brake equipment on some 1,500 freight cars, with the work to be done at company shops. The program also provides for equipping 22 locomotives and 28 cabooses with radio. More than $350,000 is allocated for equipment and improvements at the company's major car shops at Sedalia, Mo., and DeSoto, and North Little Rock, Ark. Slightly more than $150,000 is earmarked for construction of a diesel locomotive facility at Kansas City.

Pennsylvania.—The Pennsylvania will place orders for 66 new passenger-train cars to re-equip completely its New York-Washington, D. C. "Congressional" and the Washington-Boston, Mass., "Senator." Included in the order will be 32 coaches, 4 coach-lounge cars, 2 conference room cars, 16 parlor cars, 4 parlor-observation-lounge cars and 4 twin-unit dining cars.

SELECTED MOTIVE POWER AND CAR PERFORMANCE STATISTICS

FREIGHT SERVICE (DATA FROM I.C.C. M-211 AND M-240)

Item No.		Month of August 1950	Month of August 1949	Eight months ended with August 1950	Eight months ended with August 1949
3	Road locomotive miles (000) (M-211):				
3–05	Total, steam	31,637	31,817	225,785	273,996
3–06	Total, Diesel-electric	18,842	13,632	134,198	96,359
3–07	Total, electric	881	791	6,527	6,571
3–04	Total, locomotive-miles	51,368	46,246	366,550	376,934
4	Car-miles (000,000) (M-211):				
4–03	Loaded, total	1,848	1,539	12,527	12,016
4–06	Empty, total	874	871	6,633	6,974
6	Gross ton-miles-cars, contents and cabooses (000,000) (M-211):				
6–01	Total in coal-burning steam locomotive trains	55,404	52,651	371,455	436,998
6–02	Total in oil-burning steam locomotive trains	14,508	13,664	98,828	119,446
6–03	Total in Diesel-electric locomotive trains	54,301	39,157	379,483	276,017
6–04	Total in electric locomotive trains	2,411	2,120	17,240	17,776
6–06	Total in all trains	126,664	107,614	867,186	850,303
10	Averages per train-mile (excluding light trains) (M-211):				
10–01	Locomotive-miles (principal and helper)	1.05	1.05	1.05	1.06
10–02	Loaded freight car-miles	40.30	37.30	38.20	35.90
10–03	Empty freight car-miles	19.10	21.10	20.20	20.80
10–04	Total freight car-miles (excluding caboose)	59.40	58.40	58.40	56.70
10–05	Gross ton-miles (excluding locomotive and tender) (000)	2,764	2,606	2,645	2,541
10–06	Net ton-miles (000)	1,296	1,171	1,199	1,149
12	Net ton-miles per loaded car-mile (M-211)	32.10	31.40	31.40	32.00
13	Car-mile ratios (M-211):				
13–03	Per cent loaded of total freight car-miles	67.90	63.80	65.40	63.30
14	Averages per train hour (M-211):				
14–01	Train miles	16.60	16.80	17.00	16.90
14–02	Gross ton-miles (excluding locomotive and tender) (000)	45,341	43,219	44,263	42,324
14	Car-miles per freight car day (M-240):				
14–01	Serviceable	48.80	42.60	44.20	42.40
14–02	All	45.70	39.80	41.20	40.10
15	Average net ton-miles per freight car-day (000) (M-240)	998	799	845	811
17	Per cent of home cars of total freight cars on the line (M-240)	36.10	50.70	43.30	50.50

PASSENGER SERVICE (DATA FROM I.C.C. M-213)

Item No.		Month of August 1950	Month of August 1949	Eight months ended with August 1950	Eight months ended with August 1949
3	Road motive-power miles (000):				
3–05	Steam	12,754	15,369	93,367	130,130
3–06	Diesel-electric	15,698	13,532	115,184	99,553
3–07	Electric	1,650	1,634	12,807	13,379
3–04	Total	30,102	30,535	221,358	243,175
4	Passenger-train car-miles:				
4–08	Total in all locomotive-propelled trains	295,207	288,964	2,129,042	2,266,155
4–09	Total in coal-burning steam locomotive trains	66,545	79,244	478,212	682,070
4–10	Total in oil-burning steam locomotive trains	44,208	46,020	293,967	359,359
4–11	Total in Diesel-electric locomotive trains	166,745	146,182	1,219,207	1,078,609
12	Total car-miles per train-miles	9.67	9.28	9.41	9.14

YARD SERVICE (DATA FROM I.C.C. M-215)

Item No.		Month of August 1950	Month of August 1949	Eight months ended with August 1950	Eight months ended with August 1949
1	Freight yard switching locomotive-hours (000):				
1–01	Steam, coal-burning	1,533	1,653	11,232	14,961
1–02	Steam, oil-burning	284	249	1,907	2,256
1–03	Diesel-electric[1]	2,701	2,130	19,358	15,621
1–06	Total	4,549	4,058	32,710	33,049
2	Passenger yard switching hours (000):				
2–01	Steam, coal-burning	57	84	478	763
2–02	Steam, oil-burning	15	15	105	128
2–03	Diesel-electric[1]	237	218	1,803	1,646
2–06	Total	344	353	2,657	2,818
3	Hours per yard locomotive-day:				
3–01	Steam	8.90	7.70	7.80	8.50
3–02	Diesel-electric	17.80	17.50	17.30	17.50
3–05	Serviceable	14.90	13.50	13.90	13.40
3–06	All locomotives (serviceable, unserviceable and stored)	12.70	11.00	11.70	11.30
4	Yard and train-switching locomotive-miles per 100 loaded freight car-miles	1.71	1.83	1.80	1.90
5	Yard and train-switching locomotive-miles per 100 passenger train car-miles (with locomotives)	0.72	0.76	0.77	0.77

[1] Excludes B and trailing A units.

(Continued from page 80)

cycle. There are no regenerators. Control of the power plant, as well as that of the locomotive, is essentially the same as that used on Diesel-electric locomotives.

Since the report last year the locomotive has operated 68,000 miles and has produced 242,389,000 ton-miles. The total mileage to date is 85,000, or a total of 285,389,000 ton-miles.

The locomotive has been in service between Los Angeles, Calif., and Salt Lake City, Utah; between Ogden, Utah, and Cheyenne, Wyo., and between Cheyenne and Council Bluffs, Iowa. These locations cover elevations from sea level to 8,014 ft. and ambient temperatures from 117 deg. to -8 deg. F. The service has been average freight service in this territory, except that practically no local freight trains have been handled. Tonnages have been dictated by motor ratings on long sustained grades. On short grades 4,500 tons have been handled successfully on 1.25 per cent grade and 6,500 tons on .7 per cent grade.

Availability of the unit has been almost anything, depending on how the term is defined. Considering availability as the percentage of total time in which no mechanics are working on the locomotive, the overall availability since August, 1949, has been 39.7 per cent. This figure includes major shopping periods in which design changes were made and developmental troubles were corrected. Since these shopping periods cannot be classified as heavy maintenance, the corresponding figure with them eliminated would be approximately 58 per cent. For two months availability approached 80.

Operating cost figures, after a year and a half of test, still mean relatively little. Much of the operation has been on special fuels for special test purposes. Moreover, no heavy maintenance has been done. The locomotive still has the original wheels under it, although they are approaching their first turning. Taking operating costs as compiled, adding an estimated amount for heavy maintenance, and comparing the result with average of diesel-electric locomotive operation indicates that operating costs of gas-turbine electrics may compare favorably with diesel-electrics.

From the train-handling standpoint the locomotive continues to be quite satisfactory. It has been able to start its tonnage under all the operating conditions which it has encountered. Adhesion characteristics have been good, and the power output has continued to be above original estimates.

Progress has been made in correcting many of the things which were responsible for early troubles. There has been a marked improvement in combustion chamber life. Fuel handling and cleaning gave us a great deal of trouble, but is now closely approaching satisfactory operation. Electrical troubles have continued to be negligible. Power-plant starting has come to be a routine operation. The power-plant auxiliaries very rarely give trouble. Tunnel operation has continued to be quite satisfactory. The locomotive operated through the famous Aspen Tunnel

(Continued on page 86)

(Continued from page 84)
with no difficulty, although some trouble was experienced in Hermosa with a 50-mile trailing wind. This trouble was due primarily to the fact that operating instructions were not followed.

It is still to be learned what fuels can be burned and what fuels give trouble. The fuel-heating needs considerable refinement. There are still annoyances under border-line conditions. Fuel filtering is approaching satisfactory operation, but there still remains considerable work to be done to perfect terminal testing and maintenance on the filtering equipment.

Further testing is necessary on fuels, cold weather operation, and operation in heavy snow. There also remain many refinements on pieces of equipment which require considerable road testing.

"PLUS FACTORS FOR PASSENGER-CAR HEATING."—Vapor Heating Corporation, 80 East Jackson Boulevard, Chicago 4. 58-page paper-covered book. Photoscript from sound film strip presented for the first time at Chicago on December 15. Illustrates and describes the requirements of a railroad passenger-car heating system; the Vapor approach employed to meet these requirements; the simple basic Vapor systems that may be used, and the Vapor systems of zoning that provide temperature control in various locations of the car. Suggests a plan for modernizing older passenger cars; describes a new development in room car heating; and shows some innovations that add extra comfort factors and refinement of control to a passenger-car heating system.

SUPPLY TRADE NOTES

BALDWIN-LIMA-HAMILTON CORPORATION. —*Marvin W. Smith* continues as president, and *George A. Rentschler* as chairman of the Baldwin-Lima-Hamilton Corporation, the merger plans for which were announced in the December issue. Mr. Rentschler has been chairman of Lima-Hamilton's executive committee. *Charles E. Brinley* has resigned as chairman of the Baldwin board, but will continue as a director. *John E. Dixon*, chairman of the board of directors of the former Lima-Hamilton Corporation, has retired. *George H. Lynn* has been appointed general sales manager of the Hamilton Division of the Baldwin-Lima-Hamilton Corporation at Hamilton, Ohio. Mr. Lynn will be in charge of sales of machine tools, can machinery, diesel engines, and special equipment.

Marvin W. Smith

Mr. Lynn was in the sales department of the Westinghouse Electric Corporation from 1933 to 1939. He next became eastern representative in the sales department, lathe division, of the Axelson Manufacturing Company of Los Angeles, Cal. He was special assistant to the president of the Axelson Company prior to becoming western district manager in 1947 for the Niles Tool Works Division and the Hooven, Owens, Rentschler Division of the Lima-Hamilton Corporation at Chicago.

The item regarding the merger plans on page 762 of the December issue was incomplete. The last sentences should read:

"Pursuant to this reorganization plan, Baldwin is transferring to the newly organized Baldwin Securities Corporation its stock in the Midvale Company and in General Steel Castings Corporation and the cash derived by Baldwin from the sale earlier this year (1950) of its stock in Flannery Bolt Company, in exchange for which Baldwin is receiving all of the shares of Baldwin Securities Corporation stock. The Baldwin directors have declared a dividend to Baldwin stockholders of record November 29, 1950, in shares of the Baldwin Securities Corporation on the basis of one share of Securities Corporation stock for each share of Baldwin stock."

◆

FRANKLIN RAILWAY SUPPLY COMPANY.—*M. J. Donovan* has been appointed assistant to the president of the Franklin Railway Supply Company.

Mr. Donovan is a graduate in mechanical and electrical engineering of the University College and the Royal College of Science, Dublin, Ireland. He began his career in 1924 as a special apprentice with Kitson & Co., locomotive builders of Leeds, England. He came to America in 1926 and joined the engineering department of the Baldwin Locomotive Works, Philadelphia, Pa. He then became associated, successively with the Erie as leading locomotive draftsman, and the Chesapeake & Ohio as chief draftsman, locomotives. From 1938 to 1943 he was assistant to the chief mechanical officer both of the Erie and the C. & O. as well as of the New York, Chicago & St. Louis and the Pere Marquette. In 1943 he was named mechanical engineer of the Lima Locomotive Works, which later became a division of the Lima-Hamilton Corporation. He was appointed chief engineer of Lima-Hamilton's locomotive division early in 1950.

◆

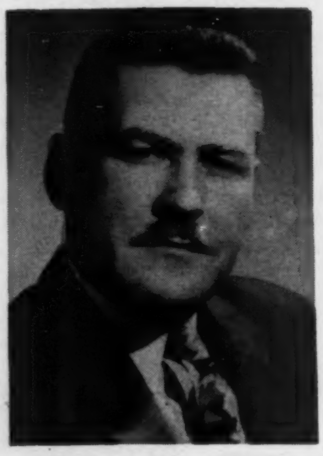
PULLMAN-STANDARD CAR MANUFACTURING COMPANY.—*Thomas C. Gray*, manager of engineering production of the Pullman-Standard Car Manufacturing Company, has been appointed director of engineering.

Mr. Gray received his high-school education in Ozark, Mo., and at San Bernardino, Calif. He obtained his B.S. degree in mechanical engineering from Purdue University in 1923 and his M. E. degree in 1927. In 1913 he became employed on the Atchison, Topeka & Santa Fe, and subsequently held various positions on that road. During World War I he was granted leave from the Santa Fe to serve in the U. S. Navy. In 1923 Mr. Gray became chief service engineer for the Locomotive Appliance Company, Toledo, Ohio, and later the same year joined the Missouri-Kansas-Texas as mechanical assistant to vice-president at Dallas, Tex. He was next appointed supervisor of apprentices on the Katy. In 1928 he joined the Barco Manufacturing Company, Chicago, as chief engineer. In 1939 he was appointed chief engineer of the Franklin Railway Supply Company, at New York. From 1942 to 1946 he served as a captain in the U. S. Navy, being stationed first at Washington, D. C., and later in Guam. In 1946 Mr. Gray became associated with the Treadwell Engineering Company, Easton, Pa., as assistant to president, and in 1948 joined the American Engineering Company, New York, as manager. Mr. Gray has been associated with Pullman-Standard since 1949, when he became manager of engineering production.

Thomas C. Gray

◆

CANADIAN RAILROAD SERVICE COMPANY. —*H. V. Gigandet*, vice-president of the Canadian Railroad Service Company, Ltd., has requested a leave of absence because of



J. V. Condon

ill health. Mr. Gigandet contemplates retirement under the company's retirement plan some time next spring. *J. V. Condon*, who has recently been appointed assistant to vice-president, will carry on in Mr. Gigandet's absence.

◆

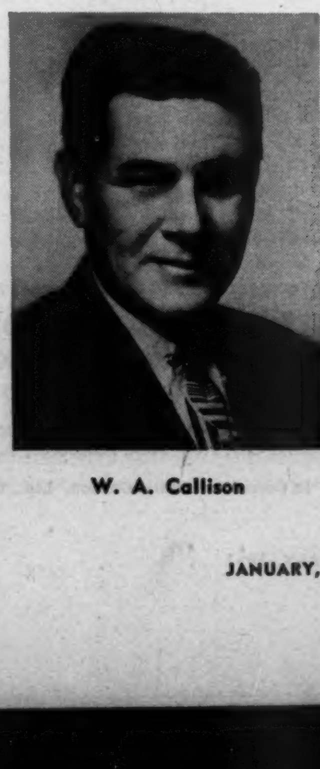
STANDARD RAILWAY EQUIPMENT COMPANY.—*J. E. Vaughn* has been appointed vice-president in charge of all sales of the Standard Railway Equipment Manufacturing Company and its subsidiaries, with direct supervision over all sales offices. Mr. Vaughn's headquarters will be in Chicago.

◆

AMERICAN LOCOMOTIVE COMPANY.—*William A. Callison*, vice-president of the American Locomotive Company in charge of western regional sales, has been assigned charge of eastern regional sales, with headquarters at New York, and *William F. Lewis*, district sales manager at St. Louis, Mo., has been appointed also a vice-president of the company, and assigned charge of western regional sales, with headquarters at Chicago. *Stephen G. Harwood*, formerly district sales manager at New York, has been appointed sales manager at the Montreal Locomotive Works, Alco's Canadian affiliate.

Mr. Callison has been associated with American Locomotive since since 1929, when he completed a special apprenticeship course at the company's Schenectady, N. Y., plant. Two years later he became a

(Continued on page 92)



W. A. Callison

(Continued from page 88)

sales representative at Chicago; in 1941, district sales manager, and in January, 1947, vice-president.

Mr. Lewis joined the Chicago sales office of American Locomotive in 1934 and was transferred to the St. Louis sales office in 1937. He was appointed district sales manager in January, 1946.

W. F. Lewis

Mr. Harwood became associated with American Locomotive at the Chicago sales office in 1936. In 1940 he was named district sales manager at San Francisco and in 1947 was transferred to New York.

S. G. Harwood

◆

PRESSED STEEL CAR COMPANY.—*Fred M. Garland* has been appointed assistant to the president and general traffic manager of the Pressed Steel Car Company. Mr. Garland will be actively engaged in the company's laminated structures program, the first development of which was its lightweight "Unicel" freight car.

◆

UNITED STATES STEEL COMPANY.—The United States Steel Corporation of Delaware, the Carnegie-Illinois Steel Corporation, the H. C. Frick Coke Company, and the United States Coal & Coke Co., four wholly owned subsidiaries of the United States Steel Corporation, have been brought together into a single operating company. According to Irving S. Olds, chairman of the board, has announced, this single company will also be a wholly owned subsidiary of the corporation, known as

Gould "Z" Plate Batteries discharge at high rate longer, give fast, sure starts. Engines are always available.

Gould's periodic inspection service and technical assistance help keep engines available—enable diesels to meet schedules.

Lead bushings built into the cover are welded to terminal posts, making acid-tight post seals. Covers remain dry. Less cleaning, less corrosion.

Your Road Runs Like Clockwork with

GOULD-EQUIPPED DIESELS!

The extra reserve power of Gould "Z" Plate Batteries gives fast, breakaway torque and continued operation in *any* weather.

96% of the entire working surface of Gould's new "Z" Plate is *regenerative* power-producing material. The grid itself is 66% more resistant. Grid porosity is reduced 85%! GOULD BATTERIES with new "Z" Plates *are* America's Finest Diesel Starting Batteries!

Only Gould has the "Z" Plate that enables Gould Batteries to operate at full capacity more months and stay new longer.

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STORAGE BATTERIES

GOULD-NATIONAL BATTERIES, INC.*

TRENTON 7, NEW JERSEY

Always Use Gould-National Automobile and Truck Batteries

*Formerly Gould Storage Battery Corporation

the United States Steel Company, and will have headquarters in a new office building in Pittsburgh, Pa. *Benjamin F. Fairless*, president of the United States Steel Corporation of Delaware, is president of this single company, and will continue as president of the parent company, the United States Steel Corporation. Vice-presidents of the United States Steel Company are: *Clifford F. Hood*—operations; *David F. Austin*—commercial; *Roger M. Blough*—law and secretarial; *Malcolm W. Reed*—engineering, and *George W. Rooney*—accounting. The sales offices of Carnegie-Illinois are now conducted in the name of United States Steel Company. Other subsidiaries of the United States Steel Corporation continue in business as in the past.

◆

Evans Products Company.—*Dave Cameron* has joined the management staff of the Evans Products Company as vice-president in charge of operations at the Plymouth, Mich., plant. Mr. Cameron will, among other things, be directly responsible for all manufacturing operations involved in production of Evans' special railroad (and other transport) loading equipment.

◆

Union Carbide & Carbon Corp.—*Franklin M. Finsthwait*, formerly eastern sales representative of the Oxweld Railroad Service Division, Union Carbide & Carbon Corp., has been appointed district sales

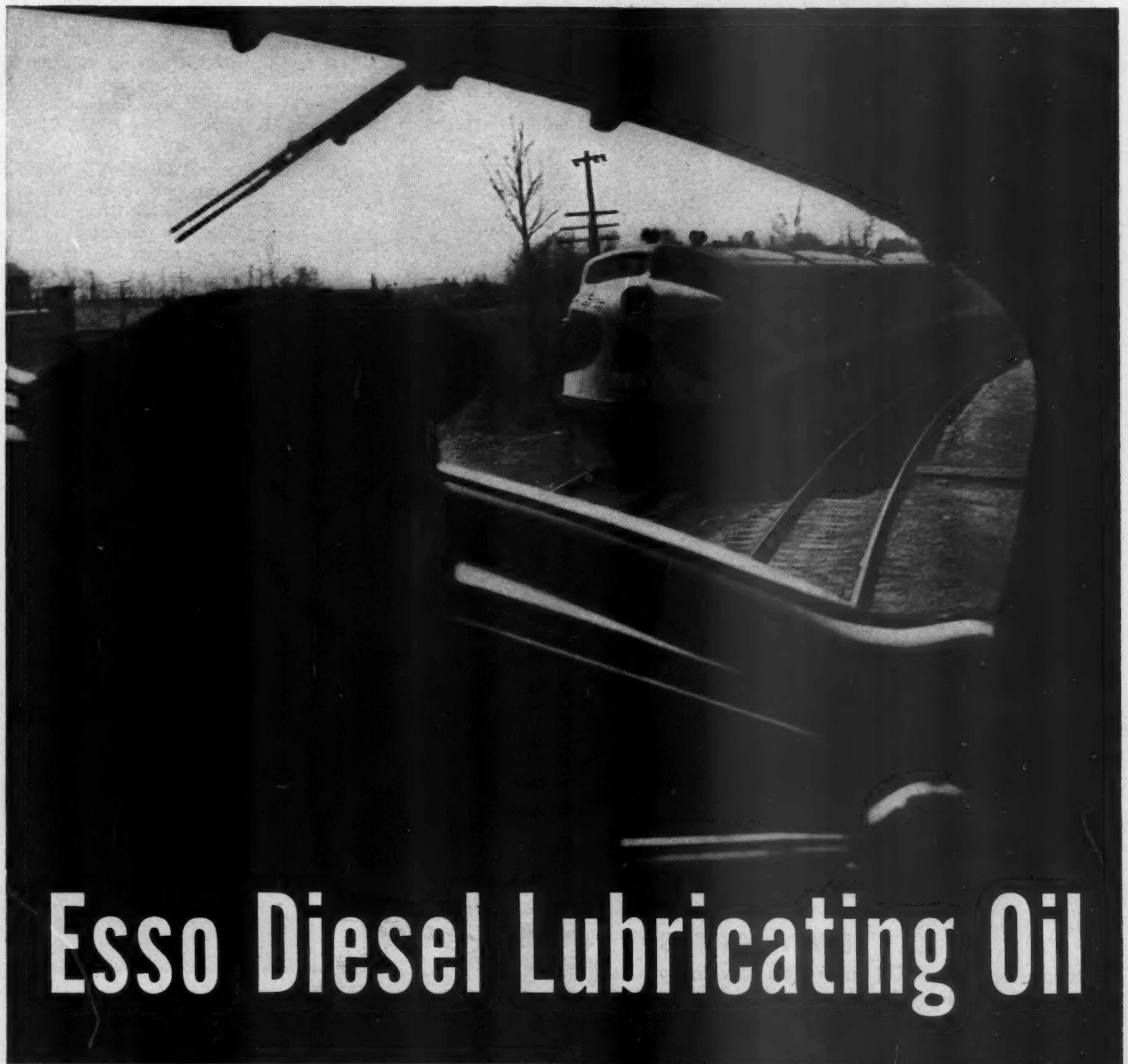
F. M. Finsthwait

manager, with headquarters at New York. Mr. Finsthwait began his business career with the Penn Steel Castings Corporation in 1931 and, before joining Oxweld in 1937, was associated with the Bethlehem Steel Export Corporation.

◆

Eutectic Welding Alloys Corporation.—Welding engineers, researchers, metallurgists, instructors, university students, and all others qualified to present basic principles of the art and science of nonfusion welding are invited to enter the Eutectic $1,000 prize competition which closes on May 31. The subject of papers to be presented is defined as "Technological and Research Aspects, Advances and Advantages of the Use of Lower Melting (lower than parent) Filler Metals in the Non-fusion Welding Processes." Application of such processes may be by torch, furnace, induction, carbon-arc or metallic arc. Papers may specifically cover one or

"Tailor-made" for Railroad Diesels



A HIGH-QUALITY LUBE FOR REAL PROTECTION —Esso offers "tailor-made" diesel locomotive lubricating oil (Diol RD) developed through years of field testing and research by both engine designers and Esso scientists to meet needs of railroad diesels. High-quality Esso Diol RD gives dependable lubrication protection.

BACKED BY CONSTANT RESEARCH—continuing tests in the lab and on the road make sure that Diol RD keeps pace with progress and latest developments in railroad diesels.

BACKED BY CONSTANT FOLLOW-UP—on-the-job check-ups by Esso Sales Engineers watch the dependable performance of Esso Railroad Fuels and Lubricants. Be sure to call on Esso for any railroad fuel or lubricating problem.

The Sign of QUALITY — Esso — The Symbol of SERVICE

RAILROAD PRODUCTS

SOLD IN: Maine, N. H., Vt., Mass., R. I., Conn., N. Y., N. J., Penna., Del., Md., D. C., Va., W. Va., N. C., S. C., Tenn., Ark., La.

ESSO STANDARD OIL COMPANY — Boston, Mass. — New York, N. Y. — Elizabeth, N. J. — Philadelphia, Pa. — Baltimore, Md. — Richmond, Va. — Charleston, W. Va. — Charlotte, N. C. — Columbia, S. C. Memphis, Tenn. — New Orleans, La.

more of the following: oxyacetylene, low melting filler; oxy-fuel gas, low melting filler; brazing and bronze welding, and hard facing and resurfacing with low melting filler. First prize is $500; second prize, $300, and third prize, $200. Rules governing the competition may be secured by writing to the Eutectic Welding Alloys Corporation, 40 Worth Street, New York 13.

A new Engineering Services Building is now being constructed at the plant of the Eutectic Welding Alloys Corporation at Flushing, L. I., N. Y.

◆

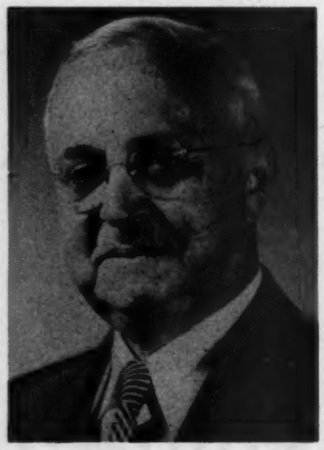
GRAYBAR ELECTRIC COMPANY.—*John T. Porter*, former manager of the Albany, N. Y., branch house of the Graybar Electric Company, has been transferred to the position of house manager at Rochester, N. Y. *Frank C. Sweeney*, former manager, telephone sales and broadcast equipment sales for the district, has been appointed manager at Albany, succeeding Mr. Porter.

◆

HULSON COMPANY.—*William K. Durbon* has been appointed vice-president of the Hulson Company, with headquarters at Chicago.

◆

ELECTRIC STORAGE BATTERY COMPANY.—*George W. Vinal* has been appointed engineering consultant and advisor to the Electric Storage Battery Company. Mr.



G. W. Vinal

Vinal recently retired as chief of the National Bureau of Standards' electrochemistry section after more than 42 years with the government.

The Electric Storage Battery Company has begun a $5,000,000 expansion program at its Crescentville (Philadelphia, Pa.) plant.

◆

AMERICAN CAR & FOUNDRY CO.—*Robert A. Harris* has been appointed chief improvement engineer in the production department of the American Car & Foundry Co., with headquarters in New York. Mr. Harris was previously assistant improvement engineer.

◆

SYMINGTON-GOULD CORPORATION.—*R. P. Brewer* has been appointed vice-president and treasurer of the Symington-Gould Corporation, with headquarters at Depew, N. Y. *H. T. Casey* has been appointed

vice-president at New York, and *D. L. Townsend* has been appointed vice-president at Chicago. *M. G. DeForest* has been appointed New England manager for the corporation.

◆

AMERICAN STEEL & WIRE CO.—*Charles H. Eisenhardt*, formerly assistant manager of the electrical products sales division of American Steel & Wire Co., a subsidiary of the U. S. Steel Corporation, has been appointed manager of the division, to succeed *T. F. Peterson*, who has resigned.

CORROSITE CORPORATION.—The *Graybar Electric Company*, 420 Lexington avenue, New York, has been appointed national distributor for "Corrosite," a new plastic paint of the Corrosite Corporation, 415 Lexington avenue, New York. L. W. Taylor, manager, outside construction sales, will be in charge of all sales activities on the Corrosite line for Graybar.

◆

WHITING CORPORATION.—*A. C. Kukral* has been appointed resident sales engineer of the Whiting Corporation, at the new sub-sales office recently opened at 637 Penton building, Cleveland, Ohio. Mr. Kukral will

A. C. Kukral

be under supervision of H. E. Reynolds, district manager at Pittsburgh, Pa. *R. E. Florine*, formerly sales engineer at the New York district sales office, has been appointed district manager of the new dis-

R. E. Florine

trict sales office in Seattle, Wash., at 350 Skinner building. Mr. Florine will be responsible for sale of Whiting engineered products (cranes, foundry equipment and railroad equipment) in Washington, Oregon and Idaho, and also will handle sale of Swenson evaporators and chemical machinery.

◆

GENERAL AMERICAN-EVANS COMPANY.—The General American-Evans Company of Detroit, Mich., has made an initial mass production run of 360 of the new "D.F." box cars (described in the June, 1950, *Railway Mechanical and Electrical Engineer*, page 309). The cars are being leased to those roads with whom General American-Evans has already negotiated leasing arrangements.

◆

ALLIS-CHALMERS MANUFACTURING COMPANY.—*Dr. H. K. Ihrig* has been elected vice-president in charge of research of the Allis-Chalmers Manufacturing Company. Dr. Ihrig was previously vice-president and director of laboratories of the Globe Steel Tubes Company.

PERSONAL MENTION

General

THOMAS T. BLICKLE, mechanical assistant of the Atchison, Topeka & Santa Fe at Chicago, has been appointed mechanical superintendent, with headquarters in Los Angeles, Calif.

A. T. G. WESTBROOK, metallurgist of the Canadian National at Montreal, Que., has been appointed chief metallurgist, with system jurisdiction.

G. W. HOSSACK, supervising chemist of the Canadian National at Montreal, Que., has been appointed research chemist, with system jurisdiction.

W. P. HARTMAN, mechanical superintendent of the Coast Lines of the Atchison, Topeka & Santa Fe at Los Angeles, Calif., has been appointed assistant general manager of the mechanical department of the Santa Fe, with headquarters in Chicago.

Car Department

J. C. JOHNSON, JR., master car builder inspector at the Roanoke, Va., shops of the Norfolk & Western, has been appointed to fill the newly created position of assistant to superintendent car department.

L. F. HARRISON, foreman car department of the Atlantic Coast Line at Wilmington, N. C., has been appointed general car inspector at Jacksonville, Fla.

W. A. FARIS, road foreman of engines at the Norfolk, Va., terminal of the Norfolk & Western, has been appointed to fill the newly created position of assistant superintendent car department.

A. P. GILSDORF, general car inspector of the Norfolk & Western at Roanoke, Va., has been appointed superintendent car department at the Roanoke shops. The position of general car inspector has been abolished.

Diesel

R. F. BATCHMAN, assistant master mechanic of the New York Central, Lines Buffalo and East, at Syracuse, N. Y., has been appointed superintendent of shop (diesel) of the Boston & Albany at West Springfield, Mass.

Electrical

W. H. RICHARDSON, supervising electrician of the Seaboard Air Line at Atlanta (Howells), Ga., has had his headquarters transferred to Hamlet, N. C.

BERT L. COCHRAN has been appointed electrical foreman at the Wyoming shops of the Chesapeake & Ohio at Grand Rapids, Mich.

HUGH W. STILLINGS, assistant foreman of the Boston & Maine at Boston, Mass., has been appointed assistant general diesel foreman at the Boston Diesel Terminal.

Master Mechanics and Road Foremen

L. E. QUIRIN has been appointed master mechanic of the Chicago-Aurora-LaCrosse Divisions of the Chicago, Burlington & Quincy, with headquarters at Chicago, succeeding E. J. Cyr, retired.

J. R. VANNORTWICK has been appointed terminal master mechanic of the Chicago, Burlington & Quincy, with headquarters at Chicago.

J. E. QUINLIVAN has been appointed assistant master mechanic of the New York Central, with headquarters at Elkhart, Ind.

L. E. MCCORKLE, assistant master mechanic of the Norfolk & Western at Bluefield, W. Va., has been appointed road foreman of engines at Norfolk, Va.

G. W. MEREDITH, general foreman at the Lamberts Point, Va., shop of the Norfolk & Western, has been appointed assistant master mechanic of the Pocahontas division, with headquarters at Bluefield, W. Va.

H. H. NIEMEYER has been appointed master mechanic of the Beardstown division of the Chicago, Burlington & Quincy, with headquarters at Beardstown, Ill.

C. A. PEASE has been appointed assistant master mechanic of the New York Central, with headquarters at Toledo, Ohio.

WALLACE H. CHAPLIN, assistant general diesel foreman of the Boston & Maine at the Boston, Mass., Diesel Terminal, has been appointed assistant to superintendent of locomotive maintenance at Boston.

E. L. HYATT, assistant master mechanic of the Boston & Albany, has been appointed master mechanic, with headquarters as before at Boston, Mass. The position of assistant master mechanic has been abolished.

A. E. LANG has been appointed assistant master mechanic of the New York Central, with headquarters at Elkhart, Ind. Mr. Lang was previously general foreman at Elkhart.

Shop and Enginehouse

W. E. HARMAN, foreman at the Lynchburg, Va., shops of the Norfolk & Western, has been appointed general foreman at the Lamberts Point, Va., shop.

D. R. MAY, foreman of the Norfolk & Western at Kenova, W. Va., has been transferred to the position of foreman at Pulaski, Va.

M. P. METZGER has been appointed general foreman of the New York Central at Englewood, Ill.

O. S. HOLMES, night enginehouse foreman of the Norfolk & Western at Portsmouth, Ohio, has been appointed foreman at the Kenova, W. Va., shop.

V. L. MINNICK, foreman of the Norfolk & Western at Pulaski, Va., has been transferred to the position of foreman at the Lynchburg, Va., shop.

W. D. WALDRON has been appointed welding supervisor of the Seaboard Air Line, with headquarters at Jacksonville, Fla.